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PUBLISHERS' ANNOUNCEMENT

THIS 1957 *Progress Volume* is the seventh of an annual series of supplements to *British Surgical Practice*. By this means the eight volumes of the main work are kept up to date in the ever increasing field of surgical knowledge, by original articles, critical surveys and abstracts.

In response to many requests a departure has been made in this volume from the previous scheme of *Surgical Progress* volumes in that the original articles are followed by general surveys of selected systems and specialties; these surveys are followed by abstracts relating to the subject.

The Noter-up section will guide the reader from the main work to the supplementary material which appears in this or previous Progress volumes. The purpose of the Noter-up remains the same as in previous years. The reader should first of all refer to the material in the main volumes of *British Surgical Practice*. Then, in order to ascertain the advances and changes which have been discussed in this or previous Progress volumes, he should refer, under the same heading or key number as that consulted in the main work, to the Noter-up in the latest Progress volume. There he will find details of the articles, surveys and abstracts relating to the subject which have appeared in the Progress volumes. Regional or system surveys naturally cover a wider field than in previous volumes and individually apply to more than one chapter in *British Surgical Practice*. Because of this, the main subject headings within the surveys have been linked in the Noter-up to the appropriate chapter titles of the main work. Thus by reference to the Noter-up, the reader of the main volumes is easily able to locate any new material on a particular subject even though it may be contained within a survey. The nature of surgical advance has necessitated the inclusion of new titles in the Noter-up, and for convenience and ease of reference, these are as follow: Abdomen; Antibiotics; Brain—Vascular Anomalies; Electronics; Kidney and Ureter—Nephrectomy; Kidney and Ureter—Surgical Aspects; Obstetrics; Organ Transplantation; Pelvic Organs—Viscerectomy, Pituitary Gland; Plastic Surgery—Correction of Facial Deformity; Thorax—Congenital Deformities.

Non-subscribers will find the Noter-up section of value in

that it is alphabetically arranged and gives at a glance information as to the presence or absence of recent material on any particular subject. Consequently, the book can be used independently.

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PART I—ORIGINAL ARTICLES

PART II—CRITICAL SURVEYS

INTRODUCTION

We are gratified to hear that surgeons look forward to the publication of the annual Progress Volume of *British Surgical Practice*. In due course we hope to produce a new edition of the original work. Current annual volumes will, therefore, concentrate rather more on critical surveys than on articles reporting original work, though these are not excluded We are greatly indebted to the specialists who have undertaken to review for us the recent advances in the various departments of surgery including bacteriology, obstetrics, and anaesthetics. Each survey is followed by abstracts of the current literature which have been prepared by the Publishers

It has always been our intention to lay stress upon the indications for operation rather than upon technique, and this year the two original articles may be regarded perhaps as medical rather than surgical—that by Cullinan and MacDougall which provides most helpful guidance in the difficult problem of selecting cases of colitis for operation, and that by Oakley and Catterall which is a very discriminating account of the lesions of the feet in diabetics. Furthermore, the dependence of modern surgery upon biochemistry is illustrated by Selwyn Taylor's fascinating review of endocrine-organ surgery, and Badenoch's comprehensive study of urinary surgery

The importance of bacteriology is well brought out in the masterly articles by Garrod and Shooter, which throw more light on the vexed question of hospital infection, to which further reference is made in the very practical review of abdominal surgery by Illingworth and Kay

We believe that our readers will find a great deal of useful information throughout the book and this introduction would be too long if we were to draw attention in detail to the way in which each author has picked out with fine judgment the advances which are of the greatest practical importance in his own subject—Cleland and Bromley on pulmonary surgery; Catchpole and Jepson on vascular surgery, and Drew on the surgery of the heart and great vessels, Bonney on orthopaedic and fracture surgery, and Stern on gynaecological surgery and obstetrics—all the articles are full of interest to an audience that extends beyond the individual specialties.

Bateman's article deals with a specific advance in operative technique that may lighten the burden of deafness which is so serious a social and psychological handicap Hedley Atkins's plea for a more meticulous recording of results in cancer of the breast deserves full publicity and we are glad to assist in its dissemination Anaesthetics is advancing so steadily that everything published is sure of a warm reception, and this applies in full measure to the contribution by Wyman and Pearce

We are particularly grateful to our Contributors this year for producing these informative and thoughtful commentaries at very short notice, because the changes in the planning of the volume delayed the commencement of the work. We hope that in the preparation of future volumes we will not have to impose upon our colleagues in this way.

E. ROCK CARLING
J. PATERSON ROSS

ULCERATIVE COLITIS

CLINICAL COURSE AND PROGNOSIS

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INTRODUCTION

The cause of ulcerative colitis remains unknown. Treatment is not specific. It is still based on accumulated experience and may be medical or surgical. Both methods have greatly improved in recent years and it is important to decide whether surgery is required for the treatment of an individual patient This decision is often difficult because the disease is fickle and runs an irregular and inconstant course in the majority of patients Some help may be had by studying the clinical course and prognosis of the disease in series of patients. In this connexion we make no attempt to review the extensive literature on the subject but confine our remarks mainly to our personal experience of a large number of patients seen and treated in a single hospital

The clinical course of the disease in these patients shows the difficulty, in most instances, of predicting the outcome from the previous course of the illness It does show, however, that those with a bad outcome did have certain features in common which may be of help in assessing the prognosis in future patients

The material for the present survey

In the 8 years from July 1, 1947 to June 30, 1955, 346 patients suffering from ulcerative colitis first attended the Westminster (Gordon) Hospital, London Some of these patients received medical treatment, others surgical; 170 of the patients were under the personal care of one of the authors (E R C), the remainder were under the care of our surgical colleagues and the majority were seen by one or both of us The figures were culled from a continuous follow-up which is being carried out by one of us (I P.M.M.) These 346 patients have been studied and

briefly described (Cullinan and MacDougall, 1956). Since then up-to-date information on approximately another 150 patients has been added to the follow-up. Their clinical behaviour has done no more than confirm the views we formed about the earlier patients who comprise the basis of the following review.

Prevalence of ulcerative colitis

The prevalence of ulcerative colitis in the population is difficult to assess. In the year 1946 one of us admitted to hospital every patient who came complaining of chronic diarrhoea. There were 99 consecutive patients, 41 of whom were found to be suffering from ulcerative colitis (Cullinan, 1949).

Melrose (1955) on the basis of an analysis of grouped hospital returns collected from 15 major British cities concluded that the incidence rate showed a tendency to decrease from south to north of Britain, the disease being significantly less in northern British towns. Moreover, Melrose considers that geographic location is of importance in determining the frequency of ulcerative colitis. Satisfactory data have been difficult to obtain, but so far as he is able to determine, England has the highest frequency in countries of Europe (14·8 per 10,000 hospital admissions) although he considers Spain may head the list; Switzerland seems to have the lowest frequency (Melrose, 1956).

Extent of colon involved

The severity and gravity of the disease differ greatly according to the extent of colon involved For this reason the patients are divided into three arbitrary groups. Without exception all patients had visible and characteristic changes of ulcerative colitis viewed through the sigmoidoscope Patients who had "regional" or "segmental" colitis (2 per cent of the series) and those in whom the diagnosis was in doubt are purposely omitted. The groups are: A the "diffuse" type or "total colitis", consisting of those patients with evidence of involvement of the entire colon; B the "distal" type, those patients with evidence of involvement of the distal part of the colon and the rectum; and C those patients with sigmoidoscopic evidence of ulcerative colitis but negative x-ray appearances.

The authors consider this division into arbitrary groups as being extremely important if an intelligent assessment of the outcome in particular patients is to be made. It should be stressed, however, that the groups are regarded only as different degrees of the same disease process The justification for this belief is that the sigmoidoscopic appearances were the same in all and the histological findings in rectal biopsies were identical (Lumb and Protheroe, 1955). For instance, of the 68 patients in group C all of whom had sigmoidoscopic evidence of the disease but negative x-ray findings, 26 were selected at random for rectal biopsy. In 21 of these patients the histological findings were indistinguishable from those seen in the x-ray positive patients. This histological similarity does not necessarily prove that these patients all had the same disease but the argument is reinforced by the fact that in addition to the 68 who were x-ray negative (group C) at the last examination a further 20, who were in this category when they were first seen, later became x-ray positive, 11 ultimately having the entire colon involved. This last fact illustrates another point Although it is generally recognized that the extent of colon involvement remains relatively constant in most patients, sometimes the

disease process can and does spread proximally. In addition to the 20 examples just quoted, 12 other patients first recognized as having "distal" colitis (group B) later developed "diffuse" colitis (group A), making a total of over 9 per cent of the whole series where spread was observed These changes were not related to the duration of the disease.

At the time of their last examination 38 per cent of the patients were in group A, 42 per cent in group B and 20 per cent in group C. The age at the onset of symptoms ranged from 4 to 90 years, the majority starting between the ages of 20 and 50 years. There was no important difference in age at onset in the three groups As expected, women outweighed men in the ratio of six-to-four.

Rectal biopsy

A large number of the patients suffering from ulcerative colitis have had rectal biopsies and the specimens studied histologically (Lumb, 1956; Lumb and Protheroe, 1955). Of 271 specimens from 236 cases, 170 showed evidence of active and 83 of quiescent ulcerative colitis. In most cases the histological and sigmoidoscopic findings were in agreement. It is interesting, however, that 23 cases showed sufficient mucosal healing to produce a normal appearance on sigmoidoscopy and yet on microscopy showed characteristic histological changes.

The earliest active lesion in ulcerative colitis seems to develop in the bases of the crypts, with destruction of undifferentiated cells and the development of the so-called crypt abscess. In the mildest lesions the destructive process may be limited to a portion of the crypt and in such cases it is possible for repair by thin flattened epithelium to take place without loss of the normal architecture. More commonly, numerous crypts are involved and large areas of their walls break down, liberating infective material into the submucosa and producing widespread ulceration. An additional method of ulcer formation is by the spread of the inflammatory process in the submucosa itself which strips off the overlying and relatively normal mucosa, producing the so-called lacunal abscess In 161 of the 170 active cases, ulcers were limited in depth at or above the level of the muscularis mucosae.

A small group of cases in which widespread involvement of the bowel wall with extensive muscle damage, which possibly occurred early in the disease, has been reported (Lumb, Protheroe and Ramsay, 1955) and will be referred to later when complications are discussed

Damage and repair in the diseased areas tend to go hand in hand Vascular granulation tissue is formed and fibrous tissue laid down. Epithelial regeneration takes place with the production of flattened cells growing out from adjacent surviving crypts In the quiescent phases the microscopic appearances show an intact mucosa with a considerably altered structural pattern The change is always towards a diminution in the numbers of crypts and a generalized thinning following destruction during the ulcerative phase. The regular arrangement of crypts, characteristic of the healthy mucosa, is lost when repair takes place. At this stage rectal biopsy is of particular clinical interest The symptoms may have subsided, and the sigmoidoscopic appearances may have become normal, but the biopsy shows a lesion capable of renewed ulceration. It must be emphasized, however, that these various degrees of quiescence seen in the specimens give no indication of the subsequent course of the disease

As a diagnostic method rectal biopsy is of limited clinical value in ulcerative colitis. Its chief use in the series has been as a research tool, in the study of the pathogenesis of ulcerative colitis (Lumb and Protheroe, 1955). Truelove, Richards and Horler (1955) and Truelove (1956, 1957) have used a similar technique to study the progress of patients undergoing steroid therapy. They found, as did the present authors, that naked-eye appearances closely paralleled the microscopic findings in terms of activity of inflammation or healing.

The investigation of a case of diarrhoea might well include a rectal biopsy when the sigmoidoscopic findings are normal. Of the series, 23 with normal-looking mucosa showed the typical appearances of colitis in the biopsy, thus establishing the cause of their symptoms. The technique is safe and simple; a small portion of mucosa is removed with ordinary biopsy forceps through the sigmoidoscope at 11 centimetres from the anal margin In a sequence of over 300 biopsies to date, only one patient bled freely from the biopsy, but this episode did not require treatment.

CLINICAL COURSE

Previous history

The health of the patients had usually been good before the onset of the ulcerative colitis. In particular, they had no past history of colonic disorders such as the syndrome of "irritable colon" nor of that outmoded condition named "muco-membranous colitis". There was a family history of the disease in less than 1 per cent

Mode and cause of onset

Although the onset of symptoms in all of the groups was seldom severe, it was more often abrupt than gradual In some patients early deterioration was rapid.

It is not intended to discuss the various factors which may be concerned in the development of ulcerative colitis, the essential cause of which remains unknown, but mention must again be made of the psychogenic factors.

PSYCHOGENIC FACTORS

The question of whether psychogenic factors do or do not play a part in the development of ulcerative colitis has in the past engendered considerable emotion. One reason for this is that in the earlier part of the present century it was a rigid tenet that organic disorders characterized by tissue damage, could be caused by organic factors alone With the growing realization, however, that organic disease may result from the sum of many factors, not only from the body but from the mind, the question can now be posed more coolly The suggestion that psychogenic factors might play an important part in the cause of ulcerative colitis was first made by Murray (1930). It is a significant fact that of all who have tried to repeat Murray's work, apparently no one has failed to confirm his fundamental observation Certainly, we ourselves have been convinced for many years that patients suffering from ulcerative colitis have unusual personalities, often with superimposed emotional disturbance very shortly before the onset of the initial attack

or subsequent relapses The subject has been reviewed by Groen and van der Valk (1956) and cannot be dealt with here in detail. Suffice it to say that although the patients do not fit into a rigid pattern of personality, they often have many traits in common such as emotional immaturity, dependence, and hypersensitivity, as well as often being over-conscientious and meticulous. One emotional disturbance which acts as a trigger is often a blow to their self-esteem from those on whom they most depend. To most people, the insult would seem slight and they would take some action, but these patients outwardly appear unaffected, though the inward hurt is severe. It is as if these patients, through some peculiarities of a predisposing personality, are made more vulnerable to interpersonal mental stress from which they are unable to defend themselves by words or actions In answer to direct questioning the patients usually deny the situation or its importance, especially if talking in front of others, but if they are allowed time to talk in private and are given a sense of confidence and protection, the facts become quite clear

Such a situation is, of course, by no means specific to ulcerative colitis Nor can peculiarities of the mental make-up be held to be the sole cause of the disease. Nevertheless, the recognition of the importance of psychogenic factors in the aetiology, though the mechanism remains obscure, is most important for successful treatment. Disregard of these factors when it comes to treatment is folly and leads to frequent and almost inevitable failure The matter will again be emphasized in the section on treatment.

SUBSEQUENT COURSE OF THE DISEASE

The subsequent course of the disease was predictable in only 40 of the 346 patients, that is under 12 per cent. Of these 40 patients, 2 alone ran a violently acute and fulminant co[illegible]

[illegible] die within weeks or months, usually of general peritonitis following perforation, without immediate surgical intervention. Twenty-seven patients had unremitting severe symptoms and another 11 were predictable in that they had annual or bi-annual relapse with persistent regularity It is not difficult to decide when surgery is required in such cases The remaining 306 cases, over 88 per cent of the series, however, followed the all too familiar unpredictable chronic course, marked by remissions and relapses, often lasting for many years In the series being discussed the duration of symptoms to date, to operation or to death in all three arbitrary groups, ranged from months to over 40 years, but 70 per cent of them had had symptoms for over 5 years and nearly 9 per cent for over 20 years.

The mode of onset and its severity were no guide to later occurrences Calm starts sometimes ended in later storms In the majority of patients the lengths of remissions and the severity and duration of relapses followed no regular course. In an attempt to find some sort of order in the clinical pattern of these patients, we carefully compared the course of the disease before the patient first attended for treatment at the hospital and its subsequent behaviour and we found the correlation to be so slight as seldom to be of any value.

EXTENT OF COLON INVOLVED AND SEVERITY

The severity of symptoms in the initial attack and in relapses is, however, directly related to the extent of colon involved, which is the reason we have made the arbitrary division into the three groups already described In group A, "diffuse colitis" or "total colitis", the patient may become gradually or suddenly profoundly ill. There may be high fever, extreme exhaustion, dehydration, toxicity and emaciation. Severe diarrhoea is the rule. Group B, the "distal" type, where only part of the colon is involved adjacent to the rectum, is characterized more by bleeding and anaemia with far less general upset A few exceptions to this will be mentioned later There may be either diarrhoea or constipation.

In group C, where there is sigmoidoscopic evidence of the disease, but normal x-ray appearance of the bowel, bleeding is usually the only symptom. Occasionally, mild fever is seen. Although the stools are sometimes loose, there is often constipation.

A study of the course of the disease after treatment for the attack which first brought the patient to the Gordon Hospital illustrates these differences in severity according to the extent of colon involved. We have subdivided these symptoms into five grades: none, trivial, moderate, severe and very severe. "None" means no symptoms since recovering from the attack. "Trivial" implies occasional looseness of the stools or bleeding from the rectum, with long remissions. Work and recreation are not impaired. "Moderate" symptoms are defined as attacks of diarrhoea with 3–8 bowel actions a day, often with blood. Admission to hospital is sometimes required The disease is a handicap to the patient and restricts, but usually does not prevent, work or recreation. Often there are long remissions. "Severe" symptoms mean continuous diarrhoea with 3–8 bowel actions a day, often with blood, or attacks of greater severity but with periods of remission. Many of these patients have been operated upon "Very severe" symptoms are defined as violent or relentless disease, usually fatal if operation is withheld.

The percentages of patients who had these different grades of symptoms during the course of the disease after treatment is shown in the following table (Cullinan and MacDougall, 1957):

SYMPTOMS AFTER TREATMENT

Symptoms	*Patients with symptoms (% of group)*		
	Group		
	A	*B*	*C*
None	11	20	24
Trivial	8	34	48
Moderate	11	17	13
Severe	22	9	0
Very severe	35	9	0
Insufficient information	13	11	15

By courtesy of the Editor of *Lancet*

At a glance it can be seen how different is the course of the disease in the three groups. Over half the patients in group A (diffuse colitis) suffered severe or very

severe symptoms; over half in B (distal colitis) were in virtual normal health. In C (sigmoidoscopic changes only) there were no severe symptoms at all

MORTALITY

It is clear, therefore, that the danger to life differs according to the extent of the colon involved. This is well shown in the series of 346 patients Mortality, including patients who have been operated on during this eight-year period, was 15 per cent in group A, 5·5 per cent in group B, and none in group C. In other words, the greatest danger to life, as would be expected, is when the entire colon is involved In passing, it should be remarked that 31 of the 133 patients in group A showed involvement of the terminal ileum. Mortality here was the same as in the remainder of the group

INTENSITY OF ATTACKS AND PROGNOSIS

The extent of colon involvement is a valuable guide to the probable outcome of a case largely because it is related to the severity and intensity of attacks which are, of course, the most important prognostic features. Toxaemia, malnutrition, anaemia and leucocytosis together with systemic complications are indications of severe and potentially lethal disease.

The "systemic" complications of ulcerative colitis have often been described and need no elaboration In the present series we saw them as malnutrition, hypoproteinaemia, polyarthritis, lesions resembling erythema nodosum, oral ulceration, thrombophlebitis, pyoderma gangrenosum and other skin lesions, iridocyclitis threatening blindness and peripheral neuritis, in that order More than one of these systemic complications might be present at the same time in the same patient. On analysing the series, after excluding the 68 patients in group C, in which there have been no systemic complications and no deaths, it was shown that the majority of severely ill and fatal cases had two or more of the following three features anaemia with a haemoglobin level below 70 per cent, leucocytosis of 10,000 cells per cubic millimetre or more, and one or more "systemic" complications.

This "toxic triad", as MacDougall has named it, is far less commonly seen in group B than in group A, 28 per cent of patients in group A had two or more of the features and only 4 per cent in group B. It is, however, interesting to observe, in retrospect, the striking difference in mortality between patients with none or one and patients with two or three elements in this triad, the latter being 35 per cent or nearly 12 times the former, which was only 3 per cent. Since that time a further 154 patients suffering from x-ray positive ulcerative colitis have been studied, making a total of 432 Precisely the same mortality differences have been found It is not possible, of course, to lay down definite rules on such figures, but we think that the presence of two or more features of this "toxic triad" are of such ill-omen that they may in themselves have to be considered as positive indications for surgical treatment

LOCAL COMPLICATIONS

Many of the patients had local complications of the bowel following the customary

pattern, including severe haemorrhage, strictures, pericolic and perianal lesions, submucous rectal abscess (probably more frequent than is usually thought), pseudopolyposis and others. These local complications often require operative treatment, but are not connected with fatality to the same degree as systemic complications.

The local complications of the bowel in ulcerative colitis are too well known to require detailed description and only a few comments need be made. In passing, it is interesting that in 2 patients who had developed recto-vaginal fistulas, the fistulas healed spontaneously without operation.

Concerning strictures, Dukes (1954), surveying the pathological features of ulcerative colitis seen in colectomy and rectal excision specimens from 120 patients in St. Mark's Hospital, London, makes the interesting observation that stricture formation is more often due to muscle hypertrophy than to fibrosis Concerning pseudopolyposis, he says that these inflammatory lesions occur in some 10 per cent of the long-standing cases. They are not neoplastic and are not liable to undergo malignant degeneration.

Ballooning of the colon

A small group of 7 patients showed intense thinning of the colon wall leading to dilatation of sufficiently great degree to justify the term ballooning. It arises from rapid damage involving all coats of the colon wall and has been described by Lumb, Protheroe and Ramsay (1955). The condition most commonly presents as an acute fulminating process but does not necessarily occur at an early stage in the development of the ulcerative colitis. Thus, in 4 patients it occurred less than a year after the first symptoms, but in the other 3 more than 5 years after the onset, and in one instance 16 years after. Two of the patients had "diffuse" colitis (group A), but in 5 there was no involvement of the caecum or ascending colon. None had involvement of the terminal ileum All the patients had had a colectomy performed and all specimens showed evidence of acute perforation at the time of operation and of chronic adhesions between the colon and the anterior abdominal wall, suggesting that perforation had taken place at some earlier date. Dilatation was maximal in the transverse colon in all the cases. Obstruction plays no part in the development of this condition, although strictures not directly related to dilatation were seen in one instance. The histological changes showed various degrees of damage and repair.

This intense dilatation or ballooning of the colon is seldom recorded; it represents a fulminating stage of ulcerative colitis and demands surgical treatment. Since Lumb, Protheroe and Ramsay (1955) recorded these 7 cases, there have been 3 more examples at the Gordon Hospital, making a total of 10 It is perhaps worth noting that 3 of the patients had had steroid therapy and that 7 had not.

CARCINOMA OF THE COLON AND ULCERATIVE COLITIS

There is general agreement that ulcerative colitis predisposes to carcinoma of the large gut. The magnitude of this risk still eludes precise calculation because insufficient follow-up material is available. An exact estimate of the danger of malignant change is necessary, because a high incidence of this complication would

be an argument in favour of surgical removal of the colon in all but the mildest cases of colitis.

Bargen and his colleagues (1954) reported a retrospective study of some 1,500 cases of ulcerative colitis in which they estimated that malignant change had occurred in the colons of these patients some twenty to thirty times more frequently than would have been expected had they been representative of the population as a whole. MacDougall (1954) described a study, also retrospective, in which this complication was estimated to have occurred some twenty times as often as in the general population. This incidence is enormous, because cancer of the large bowel is responsible for 3 per cent of all deaths in England and Wales, and, if true, would mean that at least half of the colitis population would expect eventually to develop a large-gut neoplasm

More recent studies of our own series suggests that this figure may need considerable revision Our group now consists of a population of over 500, aged between 12 and 94 years, with colitis histories from a few weeks to over 30 years' duration They have been followed-up for between 1 and 10 years, and during this time 3 large-bowel neoplasms have occurred It is not proposed to present the figures or calculations in detail here, but this appears to be equivalent to an annual incidence of about 1·6 per thousand, or about twice the estimated annual incidence of large-intestine neoplasm in the adult population.

Dukes (1954) reports that his earlier estimate (Counsell and Dukes, 1952) was too high The position is still not clear, and the question needs further study before an accurate answer becomes available. All workers are agreed that this complication occurs in patients with long histories Of the 10 patients we have seen here (including 7 referred to here because they had carcinoma) all except one had had symptoms for 7 years or more The relative youth of these patients is noteworthy, half being under 40 years of age when the cancer was diagnosed. This contrasts with the relative rarity of cancer in an otherwise healthy colon or rectum before the age of 50 years

"Defunctioning" operations do not protect against this complication One of the 10 cases in the present series arose in the rectal remnant after total colectomy with ileostomy had been performed, during a three-year interval pending ileo-rectal anastomosis, and this again is common experience (Dukes, 1954, MacDougall, 1954)

These growths are often unsuspected until they are far advanced, because the symptoms of colitis mask those of cancer. The growths themselves are commonly very malignant and metastasize rapidly. None of our patients with this complication has survived 5 years, 2 are alive without recurrence after 2 years; 1 after 1 year and 1 after 3 months.

ULCERATIVE COLITIS AND PREGNANCY

Because ulcerative colitis so often attacks young women it is important to know whether the disease is likely to have an adverse effect on pregnancy.

One of the authors has recently recorded the results of a study of 100 pregnancies in 64 women with colitis (MacDougall, 1956) in which the findings were broadly similar to those of Crohn and his colleagues (1956).

It was found convenient to classify the patients into the groups suggested by Abramson, Jankelson and Milner (1951) as follows:

(1) Pre-existing colitis inactive when pregnancy began.
(2) Pre-existing colitis active when pregnancy began.
(3) First attack of colitis during pregnancy.
(4) First attack of colitis during puerperium.

In only 2 cases out of the 21 pregnancies which began during an inactive phase of colitis was there any flare-up of the colitis.

In patients in whom pregnancy began during active colitis symptoms (53 pregnancies) one quarter became worse, but half were not affected and the remaining quarter actually improved, although some relapsed after delivery.

If colitis first began during pregnancy or the puerperium it was much more likely to be severe, but this is partly accounted for by the observation that first attacks of colitis are usually the worst (Rice-Oxley and Truelove, 1950), a fact which our experience confirms.

Management

The control of a flare-up during gestation, or of the dangerous first attack in pregnancy, or puerperium, presents the same problems as does the disease uncomplicated by childbearing. The temptation is to terminate the pregnancy. The only patient in our group in whom this was done remained in severe relapse for several weeks. Crohn and his colleagues (1956) nevertheless record benefit from this procedure in all 5 patients in whom the operation was performed. They draw no definite conclusions but sound a note of warning concerning the adverse effect of the mental stress produced by the loss of a much-wanted child.

Corticotrophic hormone is suggested by them as being the most potent means of controlling colitis in these circumstances, pointing out that it is unlikely to have any adverse effect on the pregnancy.

Policy for future pregnancies

A patient with colitis should be advised to avoid pregnancy while signs of activity of the disease are present. If the disease is quiescent, pregnancy appears to be reasonably safe.

If long-lasting symptoms make this goal seem unattainable it may be that the patient is really a candidate for surgical treatment because of the extent and severity of her disease. Alternatively, advice might be given her to essay pregnancy during which she would be under careful observation. Our figures show that she has a 50 per cent chance of sustaining no adverse effect and a 25 per cent chance of spontaneous remission during pregnancy. In this connexion, we noted that the influence of earlier pregnancies on colitis had no bearing on its course during subsequent gestations.

Adverse effects of colitis on pregnancy

No adverse effect of colitis on pregnancy was found, and this accords with the observations of Crohn and his colleagues (1956). The abortion-rate and stillbirth rate were the same as the estimated national figures for England and Wales and the United States of America.

INFLUENCE OF MEDICAL TREATMENT ON PROGNOSIS

No specific cure for ulcerative colitis has yet been found Claims for the efficacy of widely different agents have been made from time to time, and many of them have been used with considerable success by their advocates. But the success of a particular remedy is not proof of its specificity; the excellent results obtained by enthusiasts with such varying methods argue that interest in the patient and detailed personal attention to treatment have been the most important factors in a successful outcome, as indeed they are.

Four cardinal needs are vital to success and may be summarized as follows:

(1) Meticulous and patient nursing. Nursing must be adequate and expert Few patients will tax human endurance more than those suffering from a prolonged and severe acute attack of ulcerative colitis, yet success or failure may well depend on the skill, patience, understanding and equanimity of the nursing staff.

(2) Unremitting care in alleviating symptoms as they arise

(3) Detailed attention to nutrition, fluid and electrolyte balance, and the like.

(4) Courage, interest, patience, encouragement, and quiet confidence and faith of physician and nurses which transmit themselves to the sufferer It is here that the value of so-called supportive psychotherapy shows itself—this is, in effect, listening to the patient's story and acting as a friend and support to him in his difficulties and distress However trite these remarks may sound, it is almost impossible to over-stress them. High dividends are paid for the investment of human interest and detailed care in every individual patient Lack of interest, lack of attention, despondency and despair can end in disaster

Detailed medical management will not be discussed, except for a mention of chemotherapy, the use of antibiotics and steroid therapy.

Chemotherapy and the use of antibiotics

We have had little success with sulphonamides in the treatment of ulcerative colitis This did not surprise us because there is no evidence that the disease is primarily an infection and the role of secondarily invading organs is dubious. However, great claims have been made for the value of Salazopyrin (Bargen, 1956, Svartz, 1956) which we have not given a proper trial

We have been equally disappointed with antibiotics Neomycin, which is poorly absorbed from the gastro-intestinal tract, is useful for sterilizing the gut before an operation, for assisting to heal an open lesion in the rectum or anus, such as a fistula which has been laid open, and in violently fulminating cases where perforation threatens. Otherwise we have found them to be of little therapeutic value

Steroid therapy

Corticotrophic hormone, cortisone, predrisone and prednisolone have been used systemically and hydrocortisone locally in the rectum in about 40 patients at the Gordon Hospital.

Our experience agrees with that reported by the Medical Research Council Trial (Truelove and Witts, 1954, 1955) and is as follows Remission can be induced

by these substances in many patients, usually those who are having a severe acute attack, particularly in the earlier stages of the disease. When the drugs are effective, the results are striking and sometimes lead to a complete remission. These effects are of great value as a prelude to surgical operation in critically ill patients. We have been unable to discover any features which would help one to select the cases most likely to benefit. Undesirable side-effects are most often seen with corticotrophic hormone. Patients who fail to respond to one substance may remit satisfactorily when given another. Relapse is as likely after a remission induced by these substances as after spontaneous remission.

Recently, Truelove (1957) has reported most encouraging results with the use of *hydrocortisone hemisuccinate sodium*, dissolved in normal saline solution, instilled into the rectum. There was rapid remission of clinical symptoms with sigmoidoscopic and histological improvement in 11 out of 18 courses of treatment. When using this particular preparation it should be remembered that absorption of the preparation occurs to a slight extent (Nabarro and his colleagues, 1957), and the usual precautions must be taken if the patient has a subsequent surgical operation

INFLUENCE OF SURGICAL TREATMENT

Colectomy is now the generally accepted operation for the surgical treatment of ulcerative colitis Sometimes the decision to advise operation is easy. Certain complications threatening grave disability or death are clear enough indications for surgical treatment. Further, when the course of the disease is predictable and severe, as in the few patients who run a violently acute and fulminant course from the onset, accompanied by grave constitutional illness starting within a few hours or days of the onset, or again when patients have long-continued unremitting severe symptoms with relentless constitutional deterioration, in spite of efficient medical treatment, it would be folly to withhold operation.

The majority of patients suffering from ulcerative colitis run an irregular course which is largely unpredictable and the decision as to which of them should be advised to have the colon removed is more difficult. There is no doubt that some patients die for want of a timely operation, but to remove the colon in every case would be ridiculous and colectomy is still not an operation to be undertaken lightly. At the same time, with better pre-operative, operative and post-operative management, colectomy is becoming increasingly safer and the decision therefore grows in importance.

One great improvement in recent years has been in the management of the ileostomy. Complications of ileostomy in the past were sufficiently common and grave to make one hesitate greatly before advising it. Improvements in the fashioning of the stoma, the development of an efficient bag and skin adhesive, a better knowledge of ileostomy chemistry (Crawford and Brooke, 1957) and perhaps the social readjustment by lay ileostomy associations have robbed ileostomy of many of its former terrors No longer is there so much dread of frequent small bowel obstructions, stricture formation from the scar at the junction of ileum and skin, post-operative herniation at the site, fistula by the skin margin and serious skin irritation. In spite of these improvements, however, a permanent ileostomy is not an attractive prospect for a patient and it should be avoided if possible.

The development of operations to restore the continuity of the bowel with preservation of the rectum after the colon has been removed is a much more attractive proposition. Although it is early yet to judge, the results to date are promising. For example, Aylett (1957) reports a series of such operations carried out since 1951 on 47 patients suffering from ulcerative colitis of the "diffuse" type There were 2 deaths. Practically all patients afterwards have their bowels open several times in the 24 hours, mostly between 4 and 6 times, but this seldom seems to worry them unduly Five patients have not yet completed treatment, 31 have returned to a normal social and economic life and 6 have only minor limitations, the results of some frequency of bowel action. The surprising fact was that in most cases the diseased rectum improved rather than deteriorated after the operation.

CONCLUSION

When deciding that surgery is required in ulcerative colitis, every case has, of course, to be judged on its own merits However, the following is a summary of our present views on the indications for surgical treatment, fortified, we think, by studying the clinical course of the cases which have been discussed.

(1) When sigmoidoscopic changes of ulcerative colitis are present but the x-ray appearances of the colon after a barium enema are normal (group C), the clinical course is mild so long as there is no proximal spread. Surgical treatment is not indicated, except because of occasional local complications.

(2) In the " distal" type with evidence of involvement of the most distal part of the colon and the rectum (group B), the clinical course is usually relatively benign Such patients are unlikely to require surgical treatment, except for the relief of certain local complications. We are content that the majority of patients in this group have less disability than they would after colectomy. One is able to plan for most of them a conservative programme and reassure them about the future. Over half of the patients discussed are in virtually normal health

(3) In the "diffuse" type with evidence of involvement of the entire colon (group A), the clinical course may be very severe, leading to death or invalidism. Although some of these patients do well with medical management, surgical treatment is frequently needed.

(4) We feel that all patients who have evidence of severe toxicity, as already defined, have a disease which is potentially lethal and should have their colons removed.

(5) Finally, if operations to restore the continuity of the bowel after colectomy prove satisfactory in the long-term, we think we should advise all patients who have the diffuse type of colitis (group A) and who do not quickly improve with medical treatment should have the colon resected, and already this is being acted upon This would be advised until the day dawns when this curious disorder can be cured by medical treatment alone.

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REFERENCES

Abramson, D., Jankelson, I R., and Milner, L. R. (1951). *Amer. J. Obstet. Gynec.*, **61**, 121.
Aylett, S (1957) *Brit. med. J.*, **1**, 490.
Bargen, J. A. (1956). *Gastroenterologia, Basel*, **86**, 674
— Sauer, W. G., Sloan, W. P., and Gage, R. P. (1954). *Gastroenterology*, **26**, 32.
Counsell, P. B , and Dukes, C. E. (1952). *Brit. J. Surg.*, **39**, 485.
Crawford, N , and Brooke, B. N. (1957). *Brit. med. J.*, **1**, 864.
Crohn, B B., Yarnis, H , Crohn, E. B., Walter, R. I., and Gabrilove, L. J. (1956). *Gastroenterology*, **30**, 391.
Cullinan, E R (1949). *Proc. R. Soc. Med*, **42**, 235.
— *and MacDougall, I P. M (1956). Gastroenterologia, Basel, 86, 582.*
— — (1957) *Lancet*, **1**, 487.
Dukes, C. (1954). *Ann R. Coll. Surg., Engl.*, **14**, 389.
Groen, J., and van der Valk, J. M. (1956). *Gastroenterologia, Basel*, **86**, 591.
Lumb, G (1956). *Gastroenterologia, Basel*, **86**, 650.
— and Protheroe, R. H. B. (1955). *Lancet*, **2**, 1208.
— — and Ramsay, G. S. (1955) *Brit. J. Surg.*, **43**, 178, 182.
MacDougall, I. P. M (1954). *Brit med. J.*, **1**, 852
— (1956). *Lancet*, **2**, 641.
[illegible]

D. H (1957). *Brit. med. J.*, **2**, 272.
63.

Svartz, N. (1956). *Gastroenterologia, Basel*, **86**, 683.
Truelove, S C. (1956) *Brit. med. J.*, **2**, 1267.
— (1957). *Ibid.*, **1**, 1437.
— and Richards, W. C. D (1956) *Ibid*, **1**, 1315.
— and Witts, L. J (1954) *Ibid.*, **2**, 375.
— — (1955). *Ibid.*, **2**, 1041
— Richards, W C D., and Horler, A R (1955). *Ibid*, **2**, 1590.

THE MANAGEMENT OF LESIONS OF THE FEET IN DIABETICS

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DEFINITION

Many diabetics, especially the more elderly, complain of disabling lesions of the feet, varying from painful callosities to frank gangrene of one or more toes The truly ischaemic lesions are virtually confined to the sixth and subsequent decades, and have little relationship either to the severity of the diabetes or to its duration. In the younger age-groups the lesions are usually due to the effects of diabetic neuropathy; sepsis may complicate either type of lesion at any age.

These lesions may progress rapidly to a stage which makes amputation a life-saving necessity, but accurate diagnosis and prompt and adequate treatment will often obviate the necessity of amputation, or at least minimize its extent.

AETIOLOGY

For the purposes of description it is convenient to classify these lesions into the following types (Oakley, 1954): (1) septic, (2) neuropathic; (3) ischaemic, and (4) combinations of 1, 2 and 3.

The combined form is the most common, but it is usually possible to define the dominant factor in the combination This diagnosis is of the greatest importance as upon it depends both treatment and prognosis.

Septic lesions

Uncomplicated sepsis is probably no more common in well-controlled diabetics than in non-diabetics but, when control is poor, resistance to staphylococcal infection appears to be lowered and the incidence of sepsis—especially when affecting the toes—is increased.

Neuropathic lesions

This degenerative condition of the peripheral nerves peculiar to the diabetic state chiefly affects the nerves of the lower extremity, and is more common than has hitherto been suggested. In its less marked forms it produces a foot with some slight dulling of sensation and trophic brittleness of the skin combined with a deformity of the toes which render them particularly liable to abrasions from shoe-pressure. This combination is dangerous since lesions, especially on the plantar aspect, may reach a considerable size and depth before the patient is even aware of their presence. In the young, healing is usually uneventful but, in the elderly, the superimposition of a neuropathic lesion on an already somewhat ischaemic foot may be calamitous.

Ischaemic lesions

In a series of 146 cases of occlusive vascular disease of the feet, Martin (1953) found that symptoms and signs were absent under the age of 40 years, and only 6 cases were reported between the ages of 40 and 49 years; in subsequent decades the incidence rose progressively, being greatest over the age of 70 years.

Males were more commonly affected than females, but the duration, severity or control of the diabetic state was unrelated to the incidence of truly ischaemic lesions.

We have been unable to confirm the conception by Lundbaek (1954) of a specific diabetic angiopathy, and consider that the only factor common to patients with generalized ischaemic lesions of the feet is senility.

MORBID ANATOMY

Sepsis

The normal changes of inflammation are not effectively altered by the presence of ischaemia or neuropathy. Infected blisters may lead to a superficial cellulitis, and when this occurs on a digit a suppurative tenosynovitis may spread the infection rapidly into the sole of the foot. Secondary osteomyelitis of a phalanx or metacarpal bone is quite common, and the proximity of interphalangeal and metatarsophalangeal joints to the surface leads to a high incidence of septic arthritis with disorganization of the joint.

The position of the patient in bed is another important factor in the spread of the infection by gravity into the depths of the sole, while absolute rest in bed, so frequently prescribed, will often produce pressure necrosis of the skin of the heel with chronic ulceration.

Neuropathy

There is considerable evidence that non-myelinated nerve fibre degeneration may occur in diabetics who, on clinical examination, show no gross evidence of clinical neuropathy (Martin, 1953) These changes seem to be related less to the duration than to the control of the diabetes, and their common occurrence in elderly patients may be explained by an insidious onset of the disease in middle age and the consequent delay in diagnosis and treatment. The impairment of vasomotor responses and, to some extent, of pain conduction by interruption of the lower sensory neurone enhances the effect of minor trauma and lowers tissue resistance (Lewis, 1927) The loss of normal sensation is not confined to the skin;

normal joint sensation is also lost, often quite early, and the *neuropathic arthropathy* of Charcot not infrequently develops (Fig. 1). Such changes are most commonly seen in the interphalangeal joints which become disorganized and often secondarily infected. The tarsal joints are less frequently affected; even the ankle joint is not immune



Fig 1 —Charcot's arthropathy of the ankle

There is also clinical evidence of a peripheral motor neuritis chiefly affecting the intrinsic muscles of the feet which allows the unbalanced action of the long flexor and extensor muscles to produce a characteristic clawing of the toes; disuse atrophy, combined with minimal peri-articular infection, soon fixes the toes in their deformed position

Ischaemia

Progressive arterial occlusion as a separate entity is not so common in the diabetic as has previously been supposed, and the pathological picture of the ischaemic limb seems to be essentially the same as that found in non-diabetics. Where no coincident neuropathy exists two main types of ischaemic lesions will be found.

Progressive arterial occlusion

The changes in the vessel walls are those of atherosclerosis, the histological picture being indistinguishable from that seen in the ischaemic limb of the elderly non-diabetic patient.

There is little evidence that abnormal carbohydrate metabolism has any aetiological significance, although Lundbaek (1954) described certain minor differences in the chemical composition of the atheromatous plaques of the diabetic and non-diabetic patient.

The progressive narrowing of the lumen of the arteries results in widespread fibrosis in muscle, ligament, and the deeper layers of the skin, with associated weakness of the muscles, stiffness of the joints and inelasticity of the skin. Once the available blood supply has fallen below the minimal threshold for tissue viability a dry gangrene will appear at the periphery and spread slowly up the limb.

The devitalized tissues heal slowly after injury since the reactive hyperaemia demanded by trauma or inflammation is usually not forthcoming; gangrene distal to the lesion may readily be precipitated by such trauma.

The apparently high incidence of local ischaemic gangrene in a diabetic limb may often be explained by the fact that, owing to the reduction in appreciation of painful stimuli resulting from diabetic neuropathy, trauma is allowed to continue much longer than would be the case in a patient with a normally sensitive limb.

Sudden thrombosis of a major vessel

As the deposit of lipid increases in size the protective fibrotic layer of the intima ulcerates, exposing the calcified plaque to which a thrombus may become attached. Alternatively, the plaque itself may become detached and cause a sudden obstruction either at a bifurcation or at some other site of narrowing of the artery. In either case the flow of blood is suddenly cut off and the tissues supplied by the vessel become ischaemic; in the absence of an adequate collateral circulation gangrene will result.

Combined lesions

The combined lesion is, in fact, the one most commonly encountered, and the addition of sepsis to a foot already devitalized by ischaemia and desensitized by neuropathy accounts for many of the advanced lesions of the feet seen in elderly diabetics. Owing to the insidious onset of the disease in some of these patients, diabetes may not be suspected until the presence of infected gangrene leads to examination of the urine for sugar. Such sepsis, although usually staphylococcal, is often complicated by tinea infection.

CLINICAL PICTURE

Septic lesions

Two main types of septic lesions may be recognized: (1) superficial; and (2) deep

Superficial

Superficial septic lesions vary from infected blisters and bunions following aggravation by ill-fitting shoes to a more insidious lesion on the heel There is usually an area of subcutaneous inflammatory oedema of greater or less extent, and a frank abscess often develops which requires drainage.

Deep

A perforating ulcer, usually in a neuropathic foot, carries sepsis into the deeper parts of the foot and later often involves the metatarsophalangeal joints A web-space infection may also track backwards along a tendon sheath and lead to deep abscess formation This tendency is aggravated by the position in which the foot lies in bed, and gravity may ultimately lead to the formation of a pool of pus round the front of the os calcis. It is important to remember that when this deep sepsis complicates a neuropathy the pain is far less than might be expected, and the diagnosis must often be made on clinical or radiological signs alone.

Neuropathic lesions

Comparatively few patients show the marked sensory and motor changes of a fully developed diabetic neuropathy, but less severe degrees of impairment of sensation are not uncommon.

Sensory

In the early stage paraesthesiae in the feet and hands, pains in the legs, and calf tenderness are the most common findings Impairment of pain sensibility often precedes that of touch or pressure Trophic changes in the skin with excessive keratinization usually start round the nails and at the weight-bearing points, and render the skin simultaneously brittle and difficult to cleanse

The joints may be disorganized by a Charcot arthropathy, while the impairment of the autonomic vasomotor responses accounts for the thermal paraesthesiae and lowers the local tissue resistance to trauma The ankle jerks are lost at a relatively early stage of the disorder, as also may be the vibration sense, but this latter sign is of little diagnostic significance in old age

Motor

Many of these patients show quite characteristic deformity of the toes, which take up an excessively clawed position, often progressing to subluxation of the metatarsophalangeal joints This clawing of the toes is never associated with the tight plantar fascia and inelastic tendo Achillis of the true pes cavus, and is considered to be due to a paresis of the intrinsic muscles of the foot which allows the unbridled action of the long flexors and extensors to pull the toes into the deformed position (Fig 2) This deformity is at first mobile and correctable, but secondary changes in the joint capsule soon splint the toes in the deformed position. The



FIG. 2 —Neuropathic deformity of the feet

absence of the normal heel and toe movements in walking places an additional thrust on the metatarsal heads, and the underlying skin passes inexorably through the stage of ugly callosities to the formation of indolent ulcers.

Ischaemic lesions

The symptoms attributable to ischaemia may take the form of a slowly progressive disability or of a sudden and calamitous obstruction of a major vessel. The gradual onset is the more common and produces a feeling of coldness in the limb, often coupled with intermittent claudicant pain in the calf. As the process becomes more marked a burning pain is felt in the foot itself which is aggravated by heat and is therefore worse at night. The whole foot develops an atrophic appearance, the skin becoming smooth, hairless and shiny. The colour may be pale or deep pink; the latter is more frequently associated with severe pain. Arterial pulsation may be absent at any level below the femoral artery, but, as the oscillometer may show, absence of palpable pulsation in the arteries round the ankle does not necessarily mean that the foot is dangerously ischaemic.

Ultimately, frank gangrene of one or more toes may develop and spread proximally over the foot Prolonged decubitus from intercurrent disease may precipitate ischaemic ulceration of the heel, a disaster which can be prevented by suspension of the limb

DIAGNOSIS

The vital diagnosis of the part played by neuropathy, ischaemia or sepsis in the production of any given lesion is made on careful clinical investigation; in

particular, the superficial similarity between the solitary arterial thrombosis in a neuropathic foot and the ischaemic gangrene of a single toe must constantly be borne in mind. Accessory methods of diagnosis usually serve only to confirm the clinical opinion.

Oscillometry

Oscillometry is often of value in assessing arterial patency. If, for instance, there is evidence that the posterior tibial artery is patent at the ankle limited operations on the foot will usually succeed.

Skin temperature tests

Such tests are difficult to interpret but, as Martin (1953) has shown, when used in conjunction with vasodilator drugs such as Priscol, they may be of considerable value in differentiating between arterial occlusion and the vasomotor disturbances associated with neuropathy.

Radiography

The chief value of radiography is to show the extent of bony involvement in any infective process. Evidence of arterial calcification is of little value in estimating arterial sufficiency and may be actually misleading Arteriography is the best test for arterial patency and is of particular value in the localization of obstruction.

As the vascular lesion in the diabetic is widespread and involves the smaller vessels, arterial surgery is rarely possible, and exact localization of obstructive lesions is therefore seldom necessary. There remains a small group of patients in whom this form of special investigation may be of great value.

Bacteriology

In any septic lesion the establishment of the nature of the causal organism and of its sensitivity to antibiotics is essential to proper treatment

GENERAL PRINCIPLES OF TREATMENT

The problems presented by various lesions or combination of lesions differ in many respects, but certain general principles of treatment can be laid down

Prophylaxis

Good control of the diabetes is of paramount importance not only in the prevention of foot lesions but also in all stages of their treatment, only in this way can the incidence of neuropathy be reduced and the consequent dangers of trauma and deformity minimized Sepsis also is less liable to occur in the well controlled diabetic The commonest factor in the production of foot lesions is trauma, usually from shoe pressure, and particular care should therefore be taken, especially in elderly patients, to make sure that footwear is well fitting and made with smooth pliable "uppers" Careless chiropody and unprotected hot-water bottles are common causes which can easily be avoided

Scrupulous cleanliness, frequent change of socks or stockings and attention to nails, corns and callosities, preferably by an experienced chiropodist, will greatly reduce the operation rate in these cases.

The treatment of tinea infection should never be neglected. Regular application of lanoline keeps the skin soft and pliable and so prevents the formation of cracks and fissures which form portals of entry for infection.

Vasodilatation

Vasodilator drugs, such as Priscol, are worth trying in early cases and may prove beneficial but, in our experience, have rarely been the means of avoiding surgery or relieving the rest pain of an ischaemic limb.

Operative treatment

(1) Expert general anaesthesia is essential; *local anaesthesia cannot be used*, and although we have no experience of freezing these limbs we consider the risk of damaging the skin of the flaps to be considerable.

(2) Tourniquets should never be used at any level or under any circumstances.

(3) Pressure points must be protected throughout the whole period of narcosis. The skin is very fragile and few greater calamities can occur than for a patient to submit to amputation only to find on waking that his hitherto sound foot has a black heel. All bony points must be supported on a soft rubber pillow; the ordinary sorbo mattress on the operating table is not sufficient protection.

(4) Tension in the soft parts must not be allowed to occur during or after the operation. We are convinced that it is this tension, often attributable to over-ambitious attempts at skin suture, which precipitates the so-called post-operative spread of gangrene; such tension must at all costs be avoided.

It is essential in the treatment of all foot lesions in the diabetic—except purely septic conditions in the relatively young—to avoid pressure on the heels; the most efficient method of ensuring this is by means of spring suspension of the limbs. Both limbs are supported in spring-loaded slings lined with felt and so adjusted that the heels are just clear of the mattress (Fig. 3). Care must be taken to prevent equinus deformity, either by means of a canvas strap attached to the sling and passing under the fore-foot or, rarely, by a well-padded plaster back-slab. An encircling plaster splint should never be used.

Septic lesions

Treatment of septic lesions in the diabetic is in no way different from that in otherwise normal patients The inflamed part should be kept at rest and preferably suspended in the manner described above. Adequate drainage should be ensured, particular attention being paid to possible involvement of underlying bones and joints. The use of antibiotics has greatly improved the prognosis and it is our practice to start treatment immediately with a combination of penicillin and streptomycin while sensitivity tests are being done and, if necessary, change over to the appropriate antibiotic as soon as the results of such tests are shown.

Neuropathic lesions

Conservative treatment

The neuropathic skin must at all times be protected from injury by the measures already described The clawing of the toes *while still mobile* can be corrected by the use of a metatarsal pad on an insole; the cheaper pad-and-garter appliance is



FIG 3 —Suspension apparatus to avoid pressure on the heels

to be avoided on account of the risk of embarrassing the circulation to the toes Once the toes have stiffened in the clawed position the pad is powerless to affect the shape of the foot, and becomes instead a mere space-occupying source of pressure in the shoe (Fig 4).



FIG 4 —Illustrating the effects of a metatarsal pad on mobile and fixed deformity of toes

It cannot be emphasized too strongly that the use of any appliance inside the shoe in the presence of stiff joints will only precipitate the very disasters it is intended to prevent A rocker bar on the sole, however, may help in mimicking a normal heel and toe movement.

Surgical treatment

Once deep ulceration has supervened surgical intervention is essential The object of the operation is to remove the underlying bony pressure point and obtain skin cover without tension Suture of the skin is only to be indulged in where there is ample skin cover, no sepsis, and an adequate blood supply, as judged by the haemorrhage at operation; in any case of doubt it is better to leave the wound unsutured Skilfully placed incisions, however, will allow of rapid healing provided the bone section has been sufficiently radical

Primary or secondary Thiersch grafting can safely be employed where necessary, and the procedure is of particular value in lesions of the outer side of the fore-foot where skin cover is otherwise often hard to obtain.

Individual disorganized toes are best amputated, but in the usual absence of any direct threat to life the long-term effects of the proposed bone section must be



Fig 5.—Neuropathic ulcer following amputation of the middle two toes.

carefully considered Removal of more than one of the three middle toes will invariably produce further deformity of the first and fifth toes with the formation of new sites of pressure necrosis (Fig 5) Amputation of all five toes at once through separate dorsal racquet incisions leaves a far more shapely foot and one with a far better prospect of useful life.

Ischaemic lesions

Conservative treatment

In the early stages ischaemia may respond to vasodilator drugs such as Priscol, and these, together with limitation of activity, may postpone the onset of pain.

Beneficial results have been reported from the prolonged administration of anticoagulants even when pain at rest has developed but, owing to its severity, analgesics such as pethidine by injection are generally required; these may, with advantage, be combined with barbiturates in order to promote sleep The affected parts should be kept cool by means of a cradle which also removes the pressure of bedclothes

If these measures fail to relieve pain it is wise to tell the patient that gangrene is ultimately inevitable, and that amputation is the only effective form of treatment Undue delay is unjustifiable and if allowed to continue for a long while "phantom" pain may persist after removal of the affected limb.

Surgical treatment

Sympathectomy—This procedure has a proven place in delaying the onset of ischaemic lesions of the feet, but once these are well developed its effect is invariably disappointing It may, however, sometimes relieve the burning pain of the pink ischaemic foot without demonstrably improving its blood supply

Amputation.—The single dry gangrenous toe presents serious problems The decision has to be made either to leave the gangrenous area to separate, or to remove the toe. Our practice is to perform local amputation without delay since experience has shown that the policy of watchful expectancy condemns the patient at the best to weeks of inactivity; at the worst the lesion either spreads to the dorsum of the foot or else becomes secondarily infected. In addition, if the patient is confined to bed, there is a very real risk of pressure gangrene of the heel

Septic and combined lesions

The whole plan of surgical intervention must be made round the available blood supply Where this is adequate the local lesion may be treated on its own merits, limited operations may safely be advised and areas of unavoidable skin-loss made good by subsequent Thiersch grafting. Where ischaemia dominates the clinical picture any surgery must be confined to the drainage of an abscess or disarticulation of a toe In either case, adequate skin cover without tension in the flaps must be achieved before healing will occur For descriptive purposes it is convenient to consider in order the problems presented by various aetiological combinations.

Septic neuropathic lesions

Any localized abscess must be drained by incisions so placed as to direct the gravitational flow of pus to the surface by the shortest possible route. Additional "stab" drains of corrugated rubber may also be employed The complication of sloughing of the walls of the drainage track need not be expected in the presence of an adequate blood supply

It is often the case that one or more joints are already destroyed by septic arthritis at the time of diagnosis In the interphalangeal joints such infection is best dealt with by disarticulation of the affected toe, the wound being allowed to heal by granulation In the metatarsophalangeal joints it is usually prudent to avoid the risk of an inoculation osteomyelitis by disarticulating the toe at the first operation and then proceeding to a more radical bone excision when the infection is under control. No hesitation need be felt in removing as much bone as



(a)



(b)

FIG. 6 —(a) V-resection of disorganized toe and metatarsal head, (b) stage of healing at the tenth post-operative day



(*a*)



(*b*)

FIG. 7.—(*a*) Below-knee amputation at completion of operation, (*b*) the same stump one month later.

layer until a 4-inch tibial stump is obtained and the fibula divided at a slightly higher level. The soft tissues are allowed to fall down over the cut ends of the bone, no suture being used (Fig 7*a*). The stump is then dressed with Vaseline gauze, covered with wool and supported in a plaster trough. On the tenth post-operative day the patient is given another anaesthetic and the wound is inspected. If there is any doubt about the presence of infection the wound is allowed to heal by granulation (Fig. 7*b*) but if, as commonly happens, all is well, a delayed primary suture is carried out. In these circumstances healing should be complete when the sutures are removed 14 days later. It is not advisable to remove the sutures earlier as the ischaemic tissues heal slowly. The stump is then bandaged firmly and is usually ready for limb-fitting in about 3 months

POST-OPERATIVE CARE

In a certain number of predominantly ischaemic lesions a stage of healing may be reached after 3–4 weeks where a small raw area remains and no further change seems to occur. In these cases a trial of walking, with suitable protection of the remaining raw area, should be made. Many of these feet heal slowly under this regime and in those which relapse the amputation, which would in any case ultimately have become necessary, can be carried out forthwith and the patient spared weeks or months of painful anxiety

PROGNOSIS

The outlook for a diabetic patient with a lesion of the foot depends entirely on the relative degree of neuropathy or ischaemia which is present. In an essentially neuropathic lesion the outlook is far more favourable than for an ischaemic one, and the vast majority, if uncomplicated by sepsis, will heal with a simple regime of rest and protection. The coincidence of ischaemia and sepsis makes the outlook more gloomy and local excision will usually be necessary before healing can be obtained. Even in the most unfavourable cases, however, there is rarely any risk that the patient will lose more than his foot and we have performed 28 below-knee amputations in the past 4 years without a single failure to obtain healing, or a death attributable to the operation. We are satisfied that the high incidence of neuropathy largely suffices to explain why lesions of the feet are more common in diabetics than in non-diabetics of comparable age and why, when treatment is based on this concept, the outlook for the diabetic with a lesion of the foot, though never very bright, need rarely be considered hopeless

REFERENCES

Lewis, T (1927) *Blood Vessels of the Human Skin and their Responses*. London, Shaw.
Lundbaek, K (1954) *Lancet*, **1**, 377
Martin, M M (1953) *Lancet*, **1**, 560
Oakley, W G. (1954) *Ann R Coll Surg. Engl*, **15**, 108.

THE CONTROL OF SURGICAL INFECTIONS WITH ANTIBIOTICS

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Developments in antibiotic therapy provide an increasing complexity of choice with little gain in therapeutic effect. New antibiotics continue to be discovered, but most of those discovered recently have a closely similar range of activity, differing, in fact, little from that of penicillin. The relationship between some is even closer than this: they are either known or may be assumed to be minor variants of the same chemical structure, with the result that a group of three or four antibiotics may rank from the point of view of bacterial resistance as a single drug. Generally a locally acquired bacterial resistance, particularly among staphylococci and to a smaller extent among various coliform bacilli, adds almost as much to the debit side of the account as the discovery of new antibiotics does to the credit.

NEW ANTIBIOTICS

Tetracycline

This substance is obtained when a Cl atom is removed from chlortetracycline (Aureomycin) or an OH group from oxytetracycline (Terramycin). It is truly remarkable that these trivial changes should have any substantial effect on the biological activity of so large a molecule, and, indeed, the differences in action of the three drugs have sometimes been exaggerated. If tetracycline has the outstanding advantages first claimed for it, it would seem that no place should be left in therapeutics for its two predecessors, yet the two manufacturers continue to market and advertise both the old and the new.

Differences in antibacterial activity are small, at most twofold as measured by estimations of minimum inhibitory concentrations *in vitro*. Tetracycline is the most active of the three against *Proteus*, oxytetracycline against *Pseudomonas pyocyanea*, and chlortetracycline against staphylococci and pneumococci (Garrod, 1956). Apart from this there is little to choose between them, and cross-resistance between them is complete, that is, an organism abnormally resistant to one will be equally so to the other two.

Apart from the minor advantage of somewhat greater stability, the principal asset of tetracycline is its lesser liability to cause undesirable side-effects. Those caused by the tetracyclines are chiefly gastro-intestinal and vary from mild nausea and diarrhoea to fulminating membranous enterocolitis Two kinds of effect need to be distinguished here. In those involving merely discomfort and no danger the drug is acting on the mucosa simply as a chemical irritant, and it seems unquestionable that tetracycline is better tolerated from this point of view. The more serious effects are due to "superinfection" with antibiotic-resistant organisms, the worst being the acute membranous enterocolitis caused by staphylococci. According to Finland and his colleagues (1954) not only is diarrhoea of any kind or degree less frequent after tetracycline, but so is staphylococcal diarrhoea It is difficult to see why this should be: a staphylococcus resistant to chlortetracycline or oxytetracycline is equally resistant to tetracycline, and the profound changes in the bowel flora which pave the way for invasion by staphylococci are produced equally by all three drugs. Judging by the experience of Gsell and Kesselring (1955), 5 of whose patients developed fatal staphylococcal enterocolitis during treatment with tetracycline, this antibiotic can certainly not be regarded as exempt from this risk. The same argument applies to superinfection with *Candida albicans*, resulting in a sore mouth, pruritus ani, and sometimes diarrhoea. there is no reason whatever why the use of any of the tetracyclines should be less liable to cause this.

Tetracycline is thus a rather better tolerated drug, but otherwise differs little in either therapeutic properties or dangers from its two closely related predecessors.

Oleandomycin

The discovery of this substance was reported in 1954, but it was not marketed until two years later, perhaps because it was at first regarded as inferior to a near equivalent already in existence Like carbomycin, which has been found wanting therapeutically, it is closely related to erythromycin, but is less active, at least *in vitro* In 1956 it nevertheless appeared on the market under two names (Romicil and Matromycin) There are two enthusiastic reports (Esselier and Keith, 1956, Siegenthaler, Keiser and Hegglin, 1956) of its use in a variety of conditions, but no adequate comparison of its action with that of another antibiotic has been reported.

One important use for this substance, and for spiramycin (Rovamycin), could be in infections caused by staphylococci resistant to other antibiotics Both are closely related to erythromycin and both are inferior to it in *in vitro* activity (spiramycin by a rather wider margin)· cross-resistance between all three can occur, although apparently it is not invariable The question to which a final answer cannot yet be given is whether oleandomycin or spiramycin possess any property in which they are superior to erythromycin to offset its lesser antibacterial activity. Present evidence favours the choice of erythromycin for any purpose for which a drug of this group is indicated

There has been a recent tendency, backed by some theoretical considerations which are not always applicable and much more strongly fostered by commercial interests, to regard mixtures of antibiotics as superior to single ones. One such preparation is a 2 1 mixture of tetracycline and oleandomycin (Sigmamycin) which is said to act synergically (English and his colleagues, 1956) Like

oleandomycin, this combination has had insufficient clinical trials for an assessment of its merits.

Novobiocin

It is encouraging to be able to say that novobiocin (Albamycin, Cardelmycin, Cathomycin, Streptonivicin, Biotexin) is something really new. Although its antibacterial "spectrum" (range of activity) is very similar to that of several antibiotics already mentioned, it is clearly quite a distinct substance, with some unusual properties. It attains much higher concentrations in the blood from a given oral dose than any other antibiotic, and these high concentrations are well maintained for two reasons: very little (up to 3 per cent of the dose) is excreted by the kidney, but excretion does occur in the bile, followed by reabsorption.

Like so many recently discovered antibiotics, it is highly active only against Gram-positive organisms, the single exception to the high resistance of the coliform group is that some strains of *Proteus* are moderately sensitive. Its principal clinical use is for the treatment of otherwise antibiotic-resistant staphylococcal infections: Martin and his colleagues (1956) were successful with 5 out of 7 cases of septic-aemia, 20 out of 22 cases of osteomyelitis, and in 13 cases of acute enterocolitis, all due to staphylococci. There are some reports of its use for the treatment of urinary tract infections but in view of the low level of renal excretion this seems an unpromising field for its use.

Novobiocin shares with most of these antibiotics the disadvantage that staphylococci can readily acquire resistance to it. Another drawback is that it can cause extensive urticaria with fever: the proportion of patients so affected varies from about 5–10 per cent after a week's treatment with 2 grammes or more daily to a much smaller number when the dose is reduced.

Vancomycin

Vancomycin (Vancocin) has a similar spectrum to the foregoing, is more actively bactericidal, and has the great advantage that bacterial resistance to it develops slowly and to only a slight degree, even under optimal conditions for this change *in vitro*. Its drawback is that since absorption from the alimentary tract is minimal and intramuscular injection is very painful, administration has to be intravenous. The principal scope for its use appears to be for otherwise resistant staphylococcal infections: the generally successful treatment of 9 such cases is reported from the Mayo Clinic (Geraci and his colleagues, 1956). These cases included 1 of septic-aemia with endocarditis, 2 of osteomyelitis, 8 of post-operative enterocolitis and 1 each of cellulitis and wound infection.

PROPHYLACTIC ADMINISTRATION

Much larger quantities of antibiotics are used by surgeons with the aim of preventing infection than for its treatment. How far this kind of use succeeds in its purpose, and how much caution or restriction is demanded by the undoubted risks involved, form the most important question connected with the use of these drugs which the surgeon has to answer. It may be helpful to restate the indications for prophylactic use in the light of further experience.

Gross trauma

Following the resounding success achieved by the general use of parenteral penicillin for certain types of battle wound in 1944, it has been universally admitted that gross trauma involving contamination calls unequivocally for this treatment. The immediate object is the prevention of gas gangrene. when primary suture is possible antibiotic treatment should not be necessary to prevent streptococcal and most other forms of septic infection which are caused by bacteria conveyed to the wound at a later stage, usually by cross-infection in hospital. The necessity for prophylactic penicillin must be judged in each case according to the nature of the wound and the risks apparently involved When penicillin is contra-indicated, chlortetracycline is an efficient alternative as a preventive of clostridial infection Full doses of either are required: *Clostridium welchii* is only moderately sensitive to penicillin, and the situation demands doses of 500,000 units of a soluble form at intervals of not more than 6 hours.

Operation in areas poorly supplied with blood

The vast majority of patients in whose tissues spores of pathogenic clostridia are implanted are none the worse because germination of these spores requires a low oxygen tension, and an adequate blood supply prevents this occurring When the blood supply is reduced, as in obliterating forms of arterial disease, this safeguard is removed. When the area of operation is subject to contamination with organisms capable of causing gas gangrene, a doubly dangerous situation exists This is precisely the situation when amputation through the upper part of the thigh is performed on account of arterial disease. The skin for a considerable distance from the anus can be shown to be contaminated with *Cl welchii*, and no skin antiseptic can be relied on to kill the spores of this organism This is, therefore, an operation calling for full antibiotic cover as defined in the preceding section

Pneumonectomy and lobectomy

In order to prevent post-operative sepsis involving either the lung or the pleural cavity, it is highly desirable to suppress bronchial infection before these operations The antibiotic indicated can be determined by an examination of the sputum In bronchiectasis, particularly in early life, the organism found is often *Haemophilus influenzae*, and the most effective antibiotic is chloramphenicol Although treatment with this is not free from risk, its use seems justified for this purpose

Operations on the mouth and throat

The mouth and throat are heavily populated with, generally, penicillin-sensitive bacteria, which may be disseminated by any operation in this area, such as tonsillectomy The transient presence of a few such bacteria in the blood is a matter of indifference in normal subjects, but may have serious consequences in those predisposed by past rheumatic fever or by congenital abnormalities to endocarditis Prophylactic penicillin is indicated in such patients. The best plan is probably to give a single large dose of a preparation containing both sodium and procaine penicillin a few minutes before operations The worst is unquestionably to start administration long beforehand: this eliminates penicillin-sensitive bacteria from the area, leaving only resistant strains which may then cause an

infection extremely difficult to treat. The object is not to sterilize the mouth and throat, which, in fact, is impracticable, but only to destroy bacteria escaping thence into the circulation.

Operations on the stomach

Gastrectomy and other operations on the stomach are highly debatable indications for antibiotic prophylaxis The comparatively scanty gastric flora is derived from the mouth and is, hence, in general penicillin-sensitive. If anything is given as a preventive of peritonitis, penicillin should consequently suffice, and this is open to much less objection than tetracycline, or penicillin with streptomycin. These treatments strongly predispose to superinfections, particularly with antibiotic-resistant staphylococci, and gastrectomy is one of the operations after which acute staphylococcal enterocolitis has most often been recorded.

There appears to be some doubt whether even penicillin cover is an advantage. Hasslinger (1956), reviewing the results of 446 gastrectomies, records an actually higher incidence of local and chest infections in patients given penicillin or sulphonamides than in those given neither. McKittrick and Wheelock (1954), who compare their own results after gastrectomy and other operations performed without antibiotic cover with those of colleagues in the same hospital who gave antibiotics, also claim that their patients did better. Linder (1957) distinguishes between operations for simple and malignant ulcers for the former he advises that antibiotic cover should not be given, and he presents solid evidence based on large numbers of cases that infective complications both at the site of operation and in the air passages are more frequent in patients so "protected" A policy of restricting the use of antibiotics, particularly for [illegible]
results in his clinic (Surgical Clinic c [illegible]
papers provide much food for thought Despite the great wealth of clinical material on which to base it, there seems to have been no study leading to an opposite conclusion

Colon operations

The colon presents a quite different problem. Operations in this area involve a much higher risk of peritonitis· the flora is the most profuse of any in the body, and all are now agreed that measures to reduce it both facilitate the operation itself and minimize its risks Treatment directed to this end began with the use of the less soluble sulphonamides: streptomycin was then added, but has been abandoned because of the rapidity with which bacterial resistance to it was acquired the tetracyclines then had a vogue, but they are now discredited because their use predisposes to superinfection by staphylococci Undoubtedly the most useful antibiotic for this purpose is now neomycin. It is not absorbed when given by the mouth and has a wide range of activity resistance to it does not develop rapidly, and its use does not in any way prejudice the subsequent use of streptomycin Before commencing treatment, the volume of the intestinal contents should be reduced by saline cathartics and a low-residue diet. The period of pre-operative medication need then not exceed 24 hours the courses of treatment lasting as much as 5 or 6 days which were formerly in vogue should by now have been universally abandoned.

Some American authors advocate combining neomycin with another antibiotic acting particularly on Gram-positive organisms and especially faecal streptococci, such as bacitracin, erythromycin, or novobiocin. Of a series of recent papers on this subject which have recently appeared together, that by Cohn and Longacre (1956–57) appears to be the most informative.

Other possible indications

Linder (1957) includes in indications for antibiotic prophylaxis, operations in areas in which infection may have particularly disastrous results, of which he instances joints and the central nervous system He also includes very prolonged operations during which the opportunity for contamination from without is extended On similar principles, it would be reasonable to include operations such as thoracoplasty, in which wide areas of tissue are exposed. These are examples in which it seems impracticable to lay down hard and fast rules

DANGERS OF ANTIBIOTIC THERAPY

The prophylactic use of antibiotics in connexion with simple, clean operations and for other unnecessary purposes is to be discouraged for three reasons, namely, expense, which may be surprisingly large, its effect in producing resistant strains of bacteria, and finally its dangers. These are of three kinds

Toxic effects

Penicillin is the only non-toxic antibiotic. Streptomycin can cause damage to the eighth nerve, chloramphenicol to the bone marrow, and the tetracyclines, if given in excessive doses, to the liver Bacitracin, and to a less extent polymyxin, are nephrotoxic when administered parenterally· neomycin so administered can be both nephrotoxic and ototoxic These dangers, some of which are comparatively remote, arise in connexion with therapeutic rather than prophylactic use.

Sensitivity reactions

These are of two kinds A patient sensitized by previous treatment may react with urticaria or some other skin eruption, with or without fever, either to further systemic administration or to local application This type of sensitivity is common to both penicillin and streptomycin to other antibiotics it is rare Alternatively, a patient sensitized to penicillin may react to a further dose by the immediate development of profound shock, in which rapid and energetic administration of adrenaline and antihistamines is necessary to save life. In a recent analysis of 12 such cases Lewis (1957) concluded that accidental intravascular injection of procaine penicillin can cause such a condition, even in non-sensitized subjects. The possibility of this alarming type of reaction affords a further strong argument against the indiscriminate use of penicillin, both because no one should incur the risk itself unnecessarily, and in order that fewer people should become sensitized and thus exposed to the risk at a later date.

Superinfections

The term superinfection was introduced to denote the replacement of the bacterial cause of an infection by another species resistant to the antibiotic,

causing a continuation or exacerbation of the original disease. It is now much more often used in reference to multiplication of resistant species somewhere in the alimentary tract, owing to suppression of the normal flora by antibiotic treatment. The antibiotics most liable to have this effect are those possessing a "broad spectrum", that is, acting on a wide range of different bacteria and thus reducing the normal population to the greatest extent. Pre-eminent among these are the tetracyclines, and the effect of giving penicillin together with streptomycin is similar. chloramphenicol has a less profound effect. Three varieties of micro-organism cause these superinfections

Coliform bacilli

Resistant strains of *Proteus* and *Pseudomonas* species may come to predominate in the lower bowel during broad spectrum antibiotic treatment. They may be responsible for some diarrhoea, but do not usually cause other ill effects.

Yeast-like fungi

Candida (*Monilia*) *albicans* exists in the normal mouth and probably elsewhere in the alimentary tract in small numbers Removal of restraints imposed by the normal flora permits the fungus to multiply excessively; frequent results are a sore mouth with or without frank thrush, diarrhoea which may be serious in patients with pre-existing intestinal disease, and pruritus ani. The infection may extend from the mouth and throat to the bronchi and lungs, and even to the blood stream many cases of *Candida* septicaemia occurring in these circumstances are now on record (for example, Matthias and Rees, 1956) It has been suggested that nystatin should be given together with antibiotics directed to reducing the bowel flora in order to eliminate this risk (Spaulding and his colleagues, 1956–57). Nystatin, in oral doses of 250,000 units three times a day, is very effective in suppressing these fungi, it is doubtful whether this antibiotic has any action outside the alimentary tract

Candida and sometimes coliform infections of the mouth alone are the only superinfections of the alimentary tract which can result from the use of penicillin by itself When large enough doses are given the penicillin content of the saliva suppresses much of the flora of the mouth. these doses have no such effect on the bowel

Staphylococci

Strains of *Staphylococcus aureus*, resistant to penicillin, streptomycin, and the tetracyclines, and sometimes to other antibiotics, are the cause of the most dangerous of all superinfections, which take the form of a fulminating enterocolitis with superficial necrosis of the mucosa mainly of the small intestine and leading rapidly to dehydration and collapse The clinical features and treatment of this condition are described elsewhere (*see* page 61). It occurs most commonly 2 or 3 days after an operation in patients who have been given antibiotics for prophylactic purposes In the remarkable series of 31 cases with 14 deaths at the Radcliffe Infirmary, Oxford, described by Cook and his colleagues (1957), combined treatment with penicillin and streptomycin was most often responsible; this combination, or one of the tetracyclines, has been given to the majority of recorded cases.

That gastrectomy is so often the operation followed by this disaster may be significant: the subjects of this and other abdominal operations receive nothing by the mouth for 1–2 days and the consequent emptiness of the small intestine may well predispose to the infection. Penicillin and streptomycin given parenterally can only reach this area by way of the bile and in no very large amounts, but in an empty lumen their concentration might still be high

The prevention of this condition involves first the control of endemic staphylococcal infection generally in the hospital ward (*see* the following chapter on Staphylococcal Infection in Hospital)· there is little doubt that the infection is acquired from elsewhere in the ward, and is not due to a strain originally in the patient himself; indeed the Oxford cases referred to amounted to an epidemic. Apparatus used for gastric and intestinal intubation should be rigorously sterilized. Many other aseptic precautions can be suggested, but much the most important preventive measure is to abolish the administration of dangerous antibiotics or antibiotic combinations as cover for operations not requiring them Indications for antibiotic prophylaxis have already been discussed

SOME THERAPEUTIC APPLICATIONS

There have been no major advances in methods of therapeutic use and few comparative studies of therapeutic effect on which to found the choice of an antibiotic. The following brief remarks about the treatment of some important classes of infection are a personal attempt to assess the present position

Haemolytic streptococcus infections

Streptococci of Lancefield's Group A, formerly the major cause of acute sepsis of many kinds, have fully retained their high degree of susceptibility to penicillin, as was to be expected on the basis of *in vitro* studies. These infections are not only so amenable to treatment as to have become almost trivial, but in an environment where penicillin is being extensively used they are rarely even seen There is no need, nor is there ever likely to be any need, to consider any antibiotic other than penicillin for their treatment

Staphylococcal infections

Staphylococci contrast strikingly with streptococci in their extraordinary capacity for acquiring antibiotic resistance, and it is for this reason that they have assumed overwhelming predominance as causes of surgical sepsis In the United

to erythromycin, leaving (at present) only such of the newest antibiotics as novobiocin and vancomycin available for the treatment of patients so unfortunate as to become seriously infected with one of these generally resistant strains

The proportion of strains resistant to each antibiotic varies from place to place· it is much lower in the general population than in hospitals, and it is lower in both situations in countries using antibiotics less freely. Although Great Britain cannot be absolved from all accusation of excessive use, it seems nevertheless

likely that at least 5 further years will elapse before we reach the frequencies of antibiotic resistance already recorded on the other side of the Atlantic. It has been facetiously suggested that just as the United States of America requires a certificate of a negative Wassermann reaction in immigrants, we should require evidence of travellers in the opposite direction that they are not bringing with them in their noses or elsewhere any peculiarly resistant staphylococci!

The merits of different antibiotics, assuming the strain to be sensitive to them, may be stated shortly. Penicillin is the first choice: unfortunately in infections acquired in hospital the organism is rarely sensitive. There is little to choose between the tetracyclines and erythromycin: both are highly effective, and the more frequent side-effects caused by the former are balanced by the greater tendency to acquisition of bacterial resistance against the latter. Both streptomycin and chloramphenicol have a lower order of activity.

A policy for dealing with these infections which should keep them under reasonable control has two bases One is the regular performance of sensitivity tests, both as a guide to the treatment of the individual patient and in order constantly to know the resistance pattern of the local staphylococcus population. The second is restricted use. It is abundantly clear that the frequency of bacterial resistance depends directly on the quantity of the antibiotic used in a given ward, hospital or population area Not only will the percentage of resistant strains rise when use is extensive, but it has been observed to fall again when use diminishes, either because the antibiotic has been found to have drawbacks (for example, chloramphenicol being observed to cause marrow aplasia) or because another has supplanted it in popularity It has been suggested on this account that anti-staphylococcal antibiotics should be used in rotation This is probably unnecessary: the use of a sufficient variety only for adequate indications should serve to maintain the frequency of resistance to the later antibiotics at a low level. It is also of the highest importance that courses of treatment should be limited in length: resistance to some of these antibiotics rarely develops in less than a week, and in a large majority of patients no purpose is served by exceeding this period of treatment Persistence in the treatment of some focus of sepsis, which by its nature is incapable of being sterilized, is the surest way to breed a resistant strain.

Peritonitis

The effective treatment of peritonitis due to perforation of some part of the lower bowel is one of the principal life-saving benefits which have accrued from advances in chemotherapy The variety of bacteria concerned is greater than in any other infection, and the most effective antibiotic is therefore likely to be one with the broadest spectrum Experience has borne this out, the tetracyclines, preferably administered intravenously, give better control over this infection than any other treatment. Of the many bacteria involved in the process, those which are more difficult to cultivate have received least attention, and this is true particularly of the *Bacteroides*. In this imperfectly studied but important genus, *Bacteroides fragilis* is the species most constantly found in appendicitis and other infections originating in the lower bowel Although most of these organisms are sensitive to penicillin, it is significant that this species is resistant to it, but sensitive

to tetracyclines (Garrod, 1955). This fact undoubtedly contributes to the efficacy of the tetracyclines when they are used for this purpose

Urinary tract infections

A greater variety of antibacterial drugs, including several classes apart from the antibiotics, is available for treating infections in this area than for any other condition. This is because the kidney concentrates the drug, so that the urine contains a much higher concentration than that attainable in the blood and tissues generally, and substances which are inactive elsewhere may also have an effect. It is, of course, desirable that the drug used should act in the tissues as well as in the urine itself: this is essential if the condition to be treated is a true pyelonephritis Nevertheless, simply to sterilize the urine without any action in the tissues at all will cure some infections how otherwise can we account for the undoubted efficacy of mandelic acid?

In no other condition is it more necessary to determine the nature of the infection and the sensitivity of the infecting agent to any drug which it is proposed to use. If the infection is coccal, it is likely to respond best to penicillin these infections have the highest cure rates (Garrod, Shooter and Curwen, 1954); erythromycin and other newer antibiotics are alternatives. If the infection is coliform, the choice lies between sulphonamides, streptomycin, the tetracyclines and polymyxin bacterial resistance is common to the first two, less common to the tetracyclines and very rare to polymyxin. Chloramphenicol, although it has been extensively used for this purpose, is probably much less effective, since 90 per cent of the excreted drug is in an inactive form This belief is borne out by the experience of Tunevall and Ericsson (1954) who studied the correlation between the results of sensitivity tests and the outcome of treatment the only discrepancy they found was that chloramphenicol appeared much less effective *in vivo* than *in vitro* Novobiocin has been tried for infections due to *Proteus*, the only coliform which is sensitive to it. here again success seems unlikely, since only about 3 per cent of the dose of this antibiotic is excreted in the urine.

Success in treatment depends on adequate and sufficiently frequent dosage: rapidly excreted drugs such as penicillin and streptomycin need to be administered four times a day, and often on the control of urinary *p*H. All antibiotics vary in activity with *p*H, and the application of this to the present problem is much more complex than is usually supposed (Eagle, Levy and Fleischman, 1952) The more important facts are that streptomycin should never be given until the urine has been rendered constantly alkaline, and that chlortetracycline, which is fully active only in an acid medium, is inadvisable for *Proteus* and some coccal infections in which urea is decomposed with the formation of ammonia, to produce a highly alkaline reaction which nothing will alter except the elimination of the organism. An even more important condition of success is the correction of any underlying abnormality (obstruction, calculus formation, glycosuria, and so on) to which the origin of the infection may be due In the series of patients studied by Garrod, Shooter and Curwen (1954) cure rates were lowest in those with demonstrable urinary tract abnormalities, highest in first attacks in those with normal urinary tracts, and intermediate in patients with no known abnormality but a history of previous attacks

Chronic infection with a urea-splitting organism leading to repeated phosphatic calculus formation has a very high ultimate mortality. In such patients the most strenuous efforts both in the laboratory and in therapeutics are called for to arrest and if possible eliminate the disease. Elaborate studies of bactericidal as well as bacteriostatic action may point to the correct treatment. A triumphant example of how such efforts may be rewarded is described by Scowen, Badenoch and Shooter (1957). The patient was a boy who had had four operations for calculus; although the infection was coliform, penicillin proved in the laboratory to be the most effective drug and its administration in large doses for many months brought about what now seems certain to be the final cure.

When the object of chemotherapy is to protect against infection over the period of an operation, it is logical to use a drug, or combination of drugs, which is effective against both of the main classes of bacteria concerned. Penicillin will protect against coccal infections, but is relatively inactive against most coliforms except *Proteus*. Sulphonamides afford protection against coliform infections, but are powerless against coccal: when they are used alone infection with *Streptococcus faecalis* often develops (Durham, Shooter and Curwen, 1954). When general protection is indicated, it would seem reasonable to administer either penicillin or erythromycin together with a sulphonamide. The same purpose would be served by a tetracycline, but for reasons stated earlier the administration of tetracyclines to patients undergoing operation is better avoided.

The references to this article appear on pages 59 and 60.

STAPHYLOCOCCAL INFECTION IN HOSPITAL

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INTRODUCTION

In the last decade staphylococci have replaced streptococci as the cause of epidemic infection in hospital. Some of this change may be due to reduced virulence of haemolytic streptococci, but there is no doubt that the main responsibility, if not the whole, must be borne by antibiotics. In the past streptococci spread from infected patients or carriers, as they still will do. The difference now is that in hospital any resulting infection is likely to be treated early, and to respond so rapidly and well that further spread of streptococci is stopped. The most significant fact behind this is that haemolytic streptococci are apparently incapable of becoming resistant to penicillin, and that despite the enormous scale on which penicillin has been used, it retains its full potency against streptococcal infections.

Staphylococci have behaved differently. These organisms have shown a remarkable ability to become resistant to one antibiotic after another. In hospitals these resistant strains have tended to accumulate, and they have presented new problems. Not only have tried techniques which controlled the spread of streptococci failed to control the spread of staphylococci, but there are indications that some of the new resistant strains are more invasive than their predecessors.

It is proposed to devote this article to current views on the way in which staphylococci spread and cause infection.

GENERAL ASPECTS

For a variety of reasons staphylococcal infection has interested some surgeons more than others, and there are differences of opinion as to its frequency and relative importance. The main reason for this has been that the occurrence of infection has been irregular, and that even within one hospital some units may have been free from sepsis while others have been less fortunate. The small number of published records makes it difficult to decide how serious a problem exists, and therefore difficult to compare present results with those obtained before antibiotics. Following the adage that there is no smoke without fire, the current interest in the prevention of sepsis argues in favour of an underlying infection rate sufficiently high to need control.

A rising infection rate was accepted by McDermott (1956) and Howe (1954), although they differed in their opinions as to its cause. McDermott believed that the rising rate is due to a change in the host, and also to the fact that hospitals now shelter patients undergoing various forms of medical treatment or operative procedures which lower their resistance. Howe postulated what is now, perhaps, the commoner view that staphylococci cause more trouble because certain of the

hospital strains spread more freely and cause infection more readily than did staphylococci in the past.

These considerations are not only of theoretical value. Unless control of staphylococcal infection comes from the use of some new drug, any rational attempt at the control of staphylococcal spread must be based on more information than we have now of the staphylococcus and reactions to it in the patient. The comparative failure, so far, to contain staphylococci, has stimulated numerous teams to study the natural history of staphylococcal infection (*see* Williams, 1956) There are several tools, some new, available for this purpose.

Record of infection

What matters to the surgeon and even more to the patient is the avoidance of infection, and it is by the absence of infection that preventive measures must in the long run be judged. Activities designed to reduce dust and the number of bacteria in the air are not ends in themselves, and must eventually be considered in terms of infection. Impressions as to the amount of sepsis occurring are apt to be misleading, and the figure can rarely be obtained in retrospect by going back and consulting patients' notes We have found one solution to this in the keeping of a wound book. In this book is entered the name of every patient undergoing operation, details such as those persons present at the time of operation, and before the patient goes home, a note of the condition of the wound. At intervals the book is examined, and after excluding patients whose wounds were septic or obviously contaminated at operation, the sepsis rate for clean operations is obtained by counting the number of patients whose wounds contained visible pus A further subdivision, not always easy, is to decide which wounds were infected at operation, and which in the ward.

Isolation of staphylococci

The examination of the bacterial content of air has been greatly assisted by the slit-sampler (Bourdillon, Lidwell and Schuster, 1948) In this machine air is sucked on to a revolving culture plate, and by counting the number of colonies which grow on the plate one can estimate the number of particles carrying bacteria present in the air. Up to the present it has not been possible to differentiate between colonies arising from a very few bacteria and those starting from particles containing possibly hundreds of organisms. As the infectivity of dangerous strains of staphylococci may depend on their ability to spread in the air in large clusters, some way of differentiation is desirable. As a research instrument in a continuous study of infection, a slit-sampler can be most valuable For the examination of isolated incidents of infection, or for use in a short-term investigation its value is limited, and more useful information can usually be obtained in less elaborate ways

A minor change in technique has simplified the isolation of staphylococci from bedding and fabrics such as curtains In the sweep plate method (Williams quoted by Blowers, Potter and Wallace, 1955) an inverted culture plate is rubbed over the surface of the material being examined. If the material is held taut, staphylococci are thrown up on to the surface of the medium, the contamination rate with spreading organisms is surprisingly low.

Bacteriophage typing of staphylococci

By the use of bacteriophages, pathogenic staphylococci can be divided into many different types (*see* Anderson and Williams, 1956) Phage types are reasonably stable, and as carriers rarely carry more than one type of staphylococcus, it is frequently possible to relate staphylococci to the people who may have shed them The technique is time-consuming and is practised in only a limited number of centres: in this country it is available through the Public Health Laboratory Service In recent years no other single item has made a greater contribution to the study of staphylococcal infection.

Smoke clouds

An ounce of practice may be worth a pound of theory, and ventilation can be tested by the simple expedient of watching the movement of clouds of smoke. In contact with air, titanium chloride forms a dense white cloud which serves well for this purpose

Bacteriologists have inevitably played their part in tracing infection. With practice and with new methods it has become possible to isolate bacteria, and frequently staphylococci, from almost all the objects which surround or serve the surgical patient. The significance of these casual isolations has still to be determined.

INFECTION IN THE OPERATING THEATRE

It is not always easy to decide whether a wound became infected at the time of operation. As a first step in tracing the source of infection a decision should, if possible, be made, and on clinical grounds pyrexia occurring shortly after operation and sepsis involving the deep layers of the wound suggest theatre infection In general, there can be no reasonable doubt that to a large degree the surgeon can control the amount of sepsis developing in his patients. Careful attention to accepted theatre procedure has been shown to produce satisfactory results, while breaches of technique have provided loopholes through which bacteria can enter the patient's wound Although this has been said, there are still circumstances which may lead to infection and which cannot be eliminated even by rigid adherence to conventional aseptic ritual A number of these circumstances have been investigated and described in print

Contact infection

Devenish and Miles (1939) described their investigations at University College Hospital of an epidemic of staphylococcal infection of clean operation wounds They traced the source to a surgeon who was a skin carrier, and suggested that he infected wounds by leakage of staphylococci through glove punctures. What was almost certainly an example of a similar sequence of events was reported recently from this hospital (Shooter and his colleagues, 1957). During a period of 9 weeks, 24 of 83 patients undergoing clean operations in one surgical unit developed wound sepsis, and with one exception all the staphylococci tested belonged to a single phage type One member of the surgical team was found to be a carrier of the offending type of staphylococcus, and examination of this

person's movements strongly suggested that he was implicated. Of the 45 operations in which he took part 21 resulted in infection, while of the 38 patients operated on in his absence only 3 became infected, and one of these was infected with coliform bacilli. Sompolinsky and his colleagues (1957) reported, from Palestine, a monthly sepsis rate for clean cases rising to 6 of 16 patients. Infection here was also due to one type of staphylococcus, carried by two members of the theatre staff No decision could be made as to the way in which the staphylococci were transmitted, but when strict attention was paid to theatre discipline, infection ceased

The admirable paper of Devenish and Miles was a landmark in the investigation of hospital infection. Nearly 20 years later it is still not known how often sepsis starts in this way. Up to a third of the gloves used at operation are found afterwards to have minute perforations and tears, and if tears in gloves were all that mattered, infection should be much commoner than it is Probably what makes this a relatively rare cause of trouble is that while over half those working in hospital carry staphylococci in their noses, so far as we know people with moist hands who are at the same time heavy hand-carriers are much less common. It may be, too, that the hand-carrier has to carry an invasive type of staphylococcus, as in our case, before he is responsible for sepsis, but as will be mentioned later, there are reasons for thinking that this is not so What can be done for the carrier of pathogenic staphylococci will be discussed in a later section.

Airborne infections

For many years it was considered unlikely that wounds were infected at operation by airborne bacteria. Interest in airborne infection dates from the work of Wells and Wells (1936, 1938) who drew attention to the presence of pathogenic bacteria in the air, and of Hart (1937, 1938) who claimed that by sterilizing the air in operating rooms with ultra-violet light, sepsis could almost be eliminated. In Great Britain these American views apparently carried little weight, and it was not until the work of Bourdillon and his colleagues some 10 years later that airborne infection was considered as a serious possibility.

Pressure ventilation

In a series of papers (Bourdillon and Colebrook, 1946; Bourdillon, McFarlan and Thomas, 1948; Girdlestone and Bourdillon, 1951) a study was made of factors affecting the number of bacteria in the air of a dressing room belonging to a burns unit, and in operating theatres These investigations showed that high bacterial counts might result from activities in the theatre, or be produced by a ventilating system which sucked air into the theatre from other parts of the hospital. Examples of this arrangement were common as in many theatres the only artificial ventilation was an extract fan intended to remove steam. Even when no extract fan was fitted, if the temperature in the theatre was above that of adjacent treatment rooms or corridors, there would be air movement into the warmer room. To remedy this, plenum or pressure ventilation was suggested When sufficient pure air was blown into the theatre the airflow could be reversed, and instead of bacteria-containing air being sucked into the theatre, air from the theatre was blown out to the surrounding rooms and corridors. There was the considerable

additional advantage that this flow of air also removed bacteria-carrying particles liberated in the theatre. As a guide, Bourdillon and Colebrook (1946) suggested that normally at quiet periods during an operation the bacterial air count should not exceed 10 per cubic foot, and if susceptible tissues like the brain were exposed, the figure should be 2 per cubic foot.

As a result of these papers, pressure ventilation for operating theatres is accepted in principle, and is installed as a routine when a new theatre is built. Until recently, however, acceptance has been to some extent in the sense that pressure ventilation appears right in theory, but in practice the risk it guards against is slight, and not sufficient to justify the expense of altering existing exhaust forms of ventilation. It is interesting at this stage to look back and see why this was so. There were a number of reasons One, clearly suggested by the writer of a leading article (1946), was that wound sepsis was something associated with war casualties, accidents or out-patient departments, and was not seen after clean surgery. Another was that some of the work had been done on a burns unit, rather than a normal surgical unit, and, an important feature, any improvements might have been due to penicillin, which was introduced at the same time as changes were made in the ventilation Probably the main reason was that while altered ventilation and changed practices in the operating theatre could be shown to lower counts of bacteria in the air, no evidence was presented that changes of this sort had any effect on the occurrence of sepsis.

Suction ventilation

Two recent papers have produced what is almost certain evidence that suction ventilation can be responsible for infection. Blowers and his colleagues (1955) described an outbreak of staphylococcal infection in a chest unit housed in a modern sanatorium, and which was sufficiently serious to close the unit Their investigation revealed a considerable number of practices which appeared undesirable, and the difficulty lay in deciding which were actually responsible for infection On clinical grounds most of the infections seemed to start in the theatre at the time of operation, and Blowers and his colleagues felt that the infecting organisms were airborne They reached this conclusion because bacterial counts on the theatre air were high, because they were unable to find any consistent association between a member of the surgical team and the infected wounds, and because there was no evidence of a breakdown in routine theatre technique or sterilization. They considered that the large number of bacteria in the theatre air was due to suction ventilation, which caused bacteria from other parts of the hospital to be sucked into the theatre, and to activities in the theatre which liberated bacteria They indicted, in particular, the bringing of patients' blankets into the theatre, as when this happened there was a very sharp rise in the number of airborne germs. Among other observations it was pointed out that movement in the theatre increases the number of bacteria in the air, and that by forethought much movement can be avoided By converting the ventilation system to one which provided positive pressure, by restricting unessential movements, and by avoiding the bringing in of patients' blankets they were able to reduce very markedly the bacterial air counts, and to reduce the infection rate from at least 10 9 per cent to 3 9 per cent

It is rarely possible to assess the influence of one factor only on infection rates, but in this case it seems clear that the improvement in sepsis was due to changes in the theatre, rather than to alterations which were made in the wards. How much the contribution of the theatre was derived from pressure ventilation, and how much by changes designed to prevent the liberation of bacteria into the air is uncertain.

From this hospital we were able to report infection arising in somewhat similar circumstances, and to link the results more closely with pressure ventilation (Shooter and his colleagues, 1956). Using a wound book one surgical unit found that in 7 months 34 of 427 clean operation wounds became septic, as shown by the appearance of pus. Investigations showed that some general source such as air was probably involved, as the infecting staphylococci belonged to many phage types, and there were no obvious breaches of accepted theatre behaviour. Smoke tests revealed that there were slow air currents from the wards to the theatre, and that there was vigorous suction of air into the theatre from the passage outside. Confirmation of the suction of contaminated air into the theatre was obtained from bacterial air counts, which were high, and presumably because of the large number of bacteria sucked into the theatre, were not appreciably influenced by activities in the theatre. Conversion of our ventilation system to positive pressure produced an immediate improvement in air counts and in the sepsis rate, and of 531 clean operations in the next 10 months only 4 became infected. Particular care was taken not to alter any other theatre practice, and it was felt that the improvement in sepsis was due solely to the change in ventilation. By accident, however, one complicating feature was introduced, incoming air was blown in from the side of the theatre with the production of a perceptible air movement over the operating table In many theatres air is blown in deliberately so as to cause the least possible disturbance to the surgeon It was suggested that this may result in the formation of a zone of almost stagnant air over the patient, into which organisms dropped to the floor from carriers may be swept, and from which organisms may slowly settle on to the patient. There was some evidence that dispersal of these zones might lead to a reduction in sepsis.

Ventilation and existing theatre arrangements

If it is gradually becoming accepted that suction ventilation may entail a risk, however careful the surgeon, there is little agreement about other aspects of theatre ventilation. Suction ventilation will not by itself be harmful if it has no source of dangerous bacteria, such as wards, from which to draw air. Similarly, high bacterial counts in the theatre air do not necessarily mean that infection must ensue, as, plainly, if none of the people present in a theatre were carriers or shedders of staphylococci, however active they were and however high their activities forced the air counts, they would not be shedding pathogenic staphylococci. This is in no sense to argue that there is no point in trying to control movement in the operating theatre, but in some hospitals, particularly those where students and nurses have to be taught, a certain amount of movement and talking is inescapable. If ventilation is efficient does movement matter? Before traditional theatre activities are changed too drastically it would be reassuring to be shown that these activities may be responsible for infection With present day interest in theatre ventilation, arrangements in new theatres are receiving keener scrutiny than in the

past, and systems in old theatres are sometimes changed. At the moment there is little agreement on the instructions that should be given to ventilation engineers, and little evidence on which these instructions could be based. It is to be hoped that Dr. R B. Blowers, who is working with an experimental theatre (Blowers, personal communication), will be able to demonstrate how the area in the operating theatre containing the patient can most easily, economically and comfortably be kept germ free.

In this section reference has been made to infection that has been traced to carriers, or was thought to have come from airborne bacteria Sepsis beyond the immediate control of the surgeon doubtless may occur in other ways There is sometimes an understandable reluctance to describe the misfortunes of one's patients in print, but there is much to be said for overcoming it, as the paucity of published records makes more difficult the study of new outbreaks as they occur.

INFECTION IN THE WARD

If views on the origin of staphylococcal infection in the theatre appear somewhat nebulous, they are clarity itself in comparison with the position in the wards In most hospitals more than half the staff and patients are staphylococcal carriers Such are the refinements of bacteriology that pathogenic staphylococci can be isolated from almost any item in the ward, and the investigator can easily find himself with a wide choice of possible routes of infection but no guide as to which are the most probable For this reason many methods of control have been suggested, some more practical than others. Before attempting a survey of the way in which staphylococci spread and how this may be prevented, it may be profitable to consider the infections which may be caused

There is increasing evidence that a clean surgical wound with the edges well in apposition is not likely to become infected, as Colebrook (1950) remarked, the best dressing for a wound is skin. Untidy surgery may leave exposed edges, while in some situations, for example, around drainage tubes, it is not always possible to bring skin edges together: wounds of this sort may become infected in the ward. Another not uncommon event is the infection of a haematoma which breaks down and discharges through the incision. A more difficult problem is presented by extensive deep burns which are very frequently infected, unless they are grafted within the first few days Infection need not be confined to the surface Patients may develop infection of the urinary tract or lungs, or enterocolitis, all attributable to staphylococci acquired in hospital In a class by itself lies the colonization of 90 per cent or more of infants born in hospital (see, for example, Cunliffe, 1949). Noses and perhaps umbilicuses are involved and, except during an epidemic, colonization is only infrequently accompanied by sepsis. This phenomenon has attracted considerable interest, as apart from the desirability of being able to prevent epidemic staphylococcal infection in babies' nurseries, attempts have been made to study staphylococcal spread using the infant as an index of the efficacy of methods of prevention. While the rate of colonization of babies and burns has been described, it is disappointing to find that despite the large amount written about control, very few reports mention the amount of infection encountered in ordinary surgical wards.

CHEMOTHERAPY

Restriction of use of antibiotics

In turning to ways in which staphylococci spread and possible methods of control, chemotherapy is mentioned first, because in view of the success of penicillin in preventing streptococcal infection, the prospect of controlling staphylococci in a similar manner must at first sight have seemed promising. Some new drug may *accomplish what we desire; up till the present available antibiotics have failed* They have been used in two main ways. Unrestricted prescription may at first have produced satisfactory results, but this period has been followed by one in which, within hospital, sensitive strains of bacteria have been gradually replaced by *resistant ones. The proportion of resistant strains is related to the amount of* antibiotic prescribed, and to some extent a hospital, but probably not a unit within a hospital, can determine its own rate of resistant staphylococci. In Great Britain staphylococci resistant to erythromycin are rare because there has been commendable restriction of erythromycin to patients for whom it was really necessary. Before the advent of erythromycin it had not been possible to restrict the use of an antibiotic, but with the example of erythromycin before us, there is an additional incentive to use new antibiotics only when absolutely necessary, hoping that by so doing their effective span of life will be lengthened. How likely an assumption of this sort is to be upset by the introduction of a resistant strain with more than ordinary powers of spread is unknown

Combinations of antibiotics

In the treatment of tuberculosis it is usual to combine some other drug with streptomycin in the expectation that the emergence of resistant strains will be discouraged. There is so far very little evidence for or against the use of two antibiotics for such a purpose in the treatment of staphylococcal infection

Treatment of carriers

The second way in which antibiotics have been used is in the treatment of carriers (*see*, for example, Gould and Allan, 1954) This policy has had only limited success Sooner or later resistant strains of staphylococci have appeared with the antibiotics used so far. If antibiotics are to be used in local treatment of the nose to abolish the carrier state, the use of an antibiotic such as neomycin would seem sensible. Neomycin is too toxic for parenteral use and, therefore, if resistant strains to it did develop, it would not mean that another valuable drug for treatment had been lost

Another reason for limited success in the treatment of carriers has been the large [illegible] has been applied [illegible] staphylococci that unless treatment was prolonged indefinitely, the removal of one staphylococcus might merely open a place for another. The last statement suggests that only staphylococci of one phage type are present in the nose, and for most people this is the case (Williams, 1946). The possible significance of the carriage of single strains and an alternative method of treating nasal carriers are considered later.

STRAINS OF *STAPHYLOCOCCUS AUREUS*

Strains of *Staph. aureus* can easily be recognized by differences in antibiotic sensitivity or by phage typing. Until recently there has been argument as to whether strains varied in their power to cause infection. As this is a point of considerable practical importance it is proposed to summarize some of the evidence in this section. The best known change in strains of staphylococci has been in relation to their sensitivity to penicillin (Rogers, 1956). Collecting together reports from different parts of the world showed that the proportion of penicillin-resistant staphylococci isolated from hospital in-patients rose from 0–12 per cent in 1942–44 to about 80 per cent in 1955–56 For staphylococci, resistance to penicillin depends on the possession of an enzyme, penicillinase, which destroys the drug Ability to form this enzyme is not thought to be acquired normally by contact with penicillin, and it is believed that the rapid rise in resistant strains is the result of selective breeding, and of the power of some strains to spread and maintain themselves within hospital at the expense of strains sensitive to penicillin. It may be mentioned here that this applies only to penicillin· resistance to other antibiotics is the result of contact.

Early hopes that penicillinase producing resistant staphylococci would cause less serious infection than normal sensitive strains were soon disappointed; and there is now increasing evidence that a few resistant strains can cause infection more easily, or can produce more serious infection than can others. There is nothing inherently improbable in this idea, and it has been known for some time that different types of staphylococci may be associated with different aspects of staphylococcal disease for example, Group III strains with food poisoning, and a single type of Group II with impetigo (Anderson and Williams, 1956) The plainest example of the enhanced capacity of one strain to spread in hospital has been provided by a new type—type 80—first described by Rountree and Freeman (1955) from Australia Since then this organism has appeared in Great Britain, mainly in nurseries and general wards of hospitals in the south of England, and sometimes with disastrous results (Gillespie and Alder, 1957)

We experienced the spreading powers of a different type of staphylococcus in a ward, as part of the epidemic of wound infection already referred to, due to a carrier in the surgical team (Shooter and his colleagues, 1957). In addition to patients with wounds thought to be infected at operation, there were patients with chest infections, urinary infections or enterocolitis, all, with one exception, due to the same type of staphylococcus.

Pathogenic staphylococci

It is generally agreed that pathogenic staphylococci can be recognized by their ability to coagulate plasma, and that so far no other property of the staphylococcus has been a better guide in determining its pathogenicity Suggestions have been made that staphylococci from nasal carriers are less harmful than those from pyogenic lesions, but, with certain exceptions, this suggestion has still to be substantiated What does seem clear is that in some circumstances a variety of types of staphylococci can cause infection, one presumably as easily as another Airborne infection at operation is perhaps an example, as seen in our outbreak due to airborne infection in the theatre in which 17 wounds were infected by 11 different types of

staphylococci It is also clear that staphylococci, which after all are normal inhabitants of many noses, can exist in noses of patients and staff *without causing* trouble, and without any unusual steps being taken to suppress their growth This is seen regularly in medical wards, infants' nurseries, and in many surgical wards, and occurs nowadays more often with penicillin-resistant staphylococci than with sensitive ones, because in hospital the former predominate.

Staphylococci in a babies' nursery

Another possibility was described by Barber and Burston (1955) who typed staphylococci isolated in a babies' nursery. During three months there was little infection, but shortly after the end of the investigation a nurse came on duty with a boil Within a few days one baby developed acute mastitis—a more severe infection than any seen in the previous three months—and another developed conjunctivitis. Staphylococci of the same type were isolated from the nurse and both babies: it was a type which had been present during the three months when there had been little infection. This may represent enhanced virulence by *passage* although the possibility that it merely represents the introduction of a new more *active strain of the type originally present cannot be ruled out. Another alternative* pattern is that provided by invasive strains such as type 80.

"Hospital staphylococcus"

With these possible modes of behaviour in mind it is interesting to look back at the conception of a " hospital staphylococcus". The early view that each institution tended to have its own single hospital type is certainly not now true of some of the larger hospitals, if staphylococci from all sources are considered. In three months we isolated 26 different types on one surgical unit (Shooter and his colleagues, 1956) and work in progress has shown on another unit that one staphylococcus after another may become predominant This constant change appears to reflect the incessant flow of patients through the ward and the constant *importation of* new staphylococcal strains It does not, in our experience, include the nurse, about which others appear to agree (for instance, Barber and Burston, 1955). There is good evidence that nurses acquire hospital staphylococci soon after beginning work in the wards (Rountree and Barbour, 1951): what is puzzling is that despite the frequency in the wards of Group III strains resistant to several antibiotics, nurses who acquire hospital strains usually get strains resistant to penicillin only. As a corollary in this hospital they have rarely been responsible for the transfer of epidemic staphylococci of Group III to patients

Finally there is a suggestion that the penicillin-resistant staphylococci—mainly Group I—carried by many nurses can maintain their place even when their host is working in an atmosphere heavily contaminated with resistant *Group III strains*. As in some forms of minor sepsis the infecting staphylococcus is derived from the nose, support for the last statement is provided by our experience of sepsis in nurses In a total of 73 strains from nurses' infections, at a time when tetracycline-resistant staphylococci were common in the wards, 5 were sensitive to penicillin and tetracycline, 57 resistant to penicillin but sensitive to tetracycline, and only 2 resistant to both drugs (Shooter, 1957) Somewhat similar results were reported by Alder, Gillespie and Thompson (1955)

Summary

This lengthy consideration of the behaviour of different types of staphylococci has been undertaken because of its bearing on staphylococcal control. Procedures aimed at all carriers may be ineffective and extravagant in time and money if only carriers of certain types spread disease. Much remains to be done While the power to cause epidemic infection appears to be the property of particular phage types, not all strains of these types are dangerous A laboratory method of recognizing potentially dangerous strains is badly needed.

METHODS OF CONTROL OF STAPHYLOCOCCAL SPREAD

In surgical wards the control of staphylococci is achieved or attempted in many ways. These ways include legacies of attempts to control streptococci, and new procedures designed specifically to suppress staphylococci

Dressing—techniques and standards of asepsis

In a review of recent developments it should only be necessary to refer briefly to the need for a higher standard of asepsis in a surgical ward. This is the background against which other precautions have to be placed, and without this background new forms of control will be rendered valueless. When this is acknowledged it is still true that staphylococcal sepsis may occur in wards, as in theatres, despite the most rigorous application of standard aseptic measures.

Infection from the air

Among the possible sources of infection which are beyond the control of individual members of a surgical unit, the possibility that infection comes from airborne bacteria has received much attention. Staphylococci can often be isolated in considerable quantity from air in wards the difficulty lies in deciding if these organisms are responsible for new infections, or merely reflect infection already present One approach has been to regard the total number of bacteria in the ward air as an index of its contamination with pathogenic bacteria. On this basis, Wright, Cruickshank and Gunn (1944), working in a fever hospital, were able to show that measures which cut down bacterial air counts also reduced cross-infection with haemolytic streptococci. Using similar methods other workers have not been able to reduce streptococcal spread in such a satisfactory way, but nevertheless, for the next 10 years methods to reduce air counts were accepted as right in principle, and frequently put into play (*see*, for example, Marsh and Rodway, 1954)

Dust elimination

General air counts are largely a reflection of activities which stir up dust in the ward. They may be reduced by removing dust. an alternative approach is to space dust-making tasks such as bed-making as far away in time from wound dressing as convenient. Dust removal was tackled by obvious steps such as the prohibition [illegible] eping. A more [illegible] ward, with an [illegible] mation. Oiling

blankets was frequently combined with oiling floors, to roll up dust in little fluffy balls which did not blow about, and the two measures together could greatly improve air counts. No one now would care to go back to dry dusting or dry sweeping, but there is much less approval for oiling floors and bedding. The effect of oiling on the control of streptococcal spread has not been confirmed, and it has been shown to fail to suppress the spread of staphylococci (Clarke and her colleagues, 1954; our own experience and personal communications). More attention is now being paid to the isolation of staphylococci rather than general bacteria from the air, but an understanding of the significance of staphylococcal air counts must probably wait until more is known of the disease-producing powers of different strains

Cleaning of bedding

Meanwhile bedding has been dealt with in a different way. Sheets and other cotton articles present no problems because they are usually washed at temperatures which will kill vegetative bacteria.

Blankets.—Blankets are more difficult. Ideally, each hospital patient should have clean blankets, but this rarely happens. Blankets do not stand up well to repeated laundering, and are rapidly spoilt by subjection to boiling or autoclaving. As a result when blankets are washed, they are washed at a temperature which will not kill staphylococci, and staphylococci can, in fact, often be isolated readily from blankets after laundering One solution to this problem, which needs consideration on aesthetic grounds also, has been to wash blankets in water containing disinfectants (Barnard, 1952, Blowers and Wallace, 1955) When, during an epidemic or for other reasons, it is desired to sterilize blankets, they may be treated with formalin (*see* Gillespie and Alder, 1957) A more recent development has been the use of new materials. Blowers, Potter and Wallace (1957) have tested blankets made of Turkish towelling, loomstate cotton weave and synthetic polyester fibre, all of which will stand washing in boiling water. Of these, loomstate cotton weave blankets seem the most promising They are attractive in appearance and have the additional merit of costing rather less than half as much as a conventional hospital blanket. The only apparent alternative, a disposable blanket has not yet been tested

Staphylococci can easily be isolated from the blankets of patients who are carriers of staphylococci, but it is only fair to point out that there is no evidence at all that blankets play any significant part in initiating staphylococcal infection. Staphylococci do not of course multiply on blankets, and if blankets represent only a part of the patient's surroundings, their sterilization may be of only limited value.

Wound dressing in special room

Also stemming from the possibility of airborne infection is the suggestion that wounds should not be dressed in an open ward, but that dressings should be changed in a special pressure ventilated dressing-room off the ward. It has also been suggested that if all dressings are done by one team in one place, it may be possible to maintain a higher standard of asepsis. Experimental support for dressing rooms is provided by the work in a burns unit of Bourdillon and Colebrook (1946) and Lowbury (1954). Whether they are necessary for ordinary surgical

patients is open to doubt, and more facts are badly needed. The use of a dressing-room without ventilation might result in the transfer of one patient's germs to another. Even if the room could be found, any large scale adoption of ventilated dressing-rooms for existing hospitals would be costly, and before the idea is accepted, there should be some evidence that dressing-rooms prevent sepsis.

Isolation

Some outbreaks of staphylococcal infection have been so serious that it has become necessary to close and disinfect surgical wards. If it is true that spreading outbreaks of this kind are due to single strains of staphylococci, it may be possible to nip trouble in the bud by isolating patients carrying or infected with the epidemic type. Isolation accommodation is often limited, and we want to know how to recognize which carrier it is most important to isolate, and which infections disseminate staphylococci most freely. We want to know, too, how effective is isolation by barrier nursing in the ward, and whether it could be improved by the use of ultra-violet light curtains. Our own experiments are beginning to suggest that isolation of carriers and infected patients in a side room is an effective way of controlling single types of staphylococci, and that neomycin may assist in this when used for the treatment of carriers of an epidemic type. What we have found is that confining a patient to a side room, sometimes by himself, produces new nursing and social problems.

OTHER FACTORS IN WOUND INFECTION

Surgical masks

Finally something should be said of other factors which have been thought to be implicated in wound infection. Surgical masks were adopted first by Mikulicz in 1896 to shield the wound from mouth bacteria (*see* Walter, 1948). Some 14 years later they were regarded as optional accessories, although desirable for surgeons with colds (*see*, for example, Waring, 1909, Rose and Carless, 1910) By the 1920s they had become an accepted part of the surgeon's uniform. Rather surprisingly, very little is known of the role of masks in preventing the spread of staphylococci from the respiratory tract Unlike the streptococcus, the main haunt of the staphylococcus is the nose, and it is probable that carriers expel few if any staphylococci directly into the air while talking and breathing (Duguid and Wallace, 1948; Hare and Thomas, 1956) It is even possible that the wearing of masks will actually increase the number of staphylococci in the air by dislodging these bacteria from the skin This hardly seems an important factor in the operating theatre where masks are only worn once and are then re-sterilized It may well have more serious consequences in wards where for reasons of economy it is the practice to make one mask last the morning. Hung round the neck or kept in a pocket, the mask comes to resemble the pocket handkerchief in its collection of nasal organisms, and each time it is put on, the air, and the wearer's fingers, are contaminated.

Several authors (for example, Wulff, 1953) describe single cases or series of patients where infection was thought to have occurred through the use of inefficient masks, or because no masks were worn No evidence has been found of the efficacy of masks in preventing infection.

Hospital sterilizers

Hospital sterilizers have been roundly criticized in recent years According to Bowie (1955), "about 90 per cent of the sterilizers in use in Britain's hospitals and pharmacies are obsolete; they include representatives of all developmental stages in design since 1870". Bowie has been mainly concerned with design, and his opinions have been strongly supported by Howie and Timbury (1956). According to these authors the proper procedure when inspecting a hospital sterilizer is to start by enlisting the co-operation of the hospital engineer and "in our view, the engineer's inspection and the actions taken as a result of it are more important than any laboratory test". In their paper Howie and Timbury provided evidence that sterilizers which they considered unsatisfactory might fail to kill bacteria, and they made a number of detailed suggestions as to how defects of existing sterilizers may be rectified "until new equipment of simple and satisfactory design is generally available".

The questions raised here are not easy to answer. To replace 90 per cent of Britain's sterilizers would be an immense undertaking, and would divert time and money from other needed improvements As an alternative many, perhaps, would be rendered efficient by some simple modification. If sterilizers are a source of infection it should be possible to demonstrate it, and reports of this nature would be of great assistance Meanwhile Howie and Timbury's recommendation that the hospital engineer should ensure that his sterilizers are working as best they can should be followed Autoclaves do not run themselves, and it is also clearly essential that their working is understood by those in charge, and that a common fault, the too tight packing of drums, is avoided.

CONCLUSION

This article has been chiefly concerned with recent views on hospital infections with staphylococci It may not be superfluous to repeat that both in the operating theatre and the ward freedom from infection depends basically on the employment of the principles of asepsis. As we know these principles now, they are not always sufficient to prevent infection, and as has been shown research is turning to an examination of the natural history of *Staph. aureus.* Recent additions to the bacteriologist's armamentarium have greatly facilitated this work, which is undertaken in the hope that it will lead to the prevention of hospital infection.

It is understandable to examine in detail an organism which causes as much infection as a staphylococcus, but it is important to remember that there is another side to the story. No true gardener would concern himself exclusively with the seed while neglecting the soil, yet little attention has so far been paid to the patient. It is by no means clear, for instance, why only a few of the wounds exposed to airborne bacteria at operation become septic, or why conditions in one theatre cause infection, while another theatre, apparently identical, has a clear record. Smith and Dubos (1956) showed that the susceptibility of mice to infection with staphylococci could be influenced by short periods of starvation. To argue from mice to men is notoriously unsafe, but perhaps in this work there lies the key to one of the problems which confronts us.

The references to this article appear on pages 59 and 60.

ABSTRACTS RELATING TO SURGICAL INFECTIONS

Elective abdominal surgery

Routine use of antibiotics

McKittrick and Wheelock (1954) review the routine use of antibiotics in elective abdominal surgery In view of the serious complications following antibiotic coverage, their policy is to restrict it to cases with definite indications. These include chronic bronchitis, rheumatic heart disease, intestinal abscess and a low anterior resection where control of haemorrhage and bowel contents is difficult The records of 175 patients are studied In 25 subtotal gastrectomies performed for ulcer and 4 total gastrectomies for cancer, antibiotics were used pre-operatively only in 5. Of the remaining 24, whose average age was 50 years, the average time in hospital was 12 5 post-operative days, the on

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tions were wound abscess, fatal coronary occlusion and thrombophlebitis. In 24 other cases, pre-operative prophylactic antibiotics were given One patient with no pancreatitis at operation died from acute pancreatitis on the fourth day. Another developed pancreatitis, while a further patient developed atelectasis Two had wound infections and 3 had febrile perio(

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of pulmonary infarctio

patients with colostom

slight complication. Benefits, therefore, comparable with the cost and potential dangers of antibiotics appear to be disproportionate in elective operations on the gastro-intestinal and biliary tracts

Pre-operative sterilization of the colon

Comparison of antibacterial agents

Cohn and Longacre (1956–57) review pre-operative sterilization of the colon, comparing various antibacterial agents. The patients selected were without known colonic lesions. After a control stool was obtained, the patients were placed on a low-residue

administered to the selected patients and the response of the organisms analysed. Bacteria were present in the control stools of some cases, absent in others, in certain instances they appeared during therapy and disappeared at its termination The inadequate response of certain organisms and the inability to evaluate the response in others rendered 9 drugs unsatisfactory for pre-operative preparation of the colon These were chlorquinaldol, chlortetracycline, chloramphenicol, novobiocin, oxytetracycline, sulfasuxidine, sulfathalidine, tetracycline and tetracycline-nystatin. On the other hand, 3 drugs, chlorquinaldol-neomycin, neomycin and oxytetracycline-neomycin, produced elimination or control of the bacteria to a degree which made them satisfactory agents The best results, however, were given by 5 drug combinations. erythromycin-neomycin, nystatin-neomycin, novobiocin-neomycin, tetracycline-neomycin and sulfathalidine-neomycin. These are therefore recommended for pre-operative intestinal asepsis. The two last are perhaps

particularly useful, since novobiocin-neomycin would exert a highly beneficial effect in staphylococcal enteritis, while sulfathalidine-neomycin has the additional advantages of easy tolerance and absence of gastro-intestinal side reactions.

Staphylococcal infections

Current problems

ROGERS (1956) discusses the current problem of staphylococcal infections, the incidence of which has probably increased with the introduction of antimicrobials. Despite the apparent close biological connexion between staphylococci and other Gram-positive cocci, evidence suggests that the former may differ in fundamental humoral-cellular relationships within the human host. This is examined Although a high natural resistance to staphylococcal infection exists, certain alterations in the host lead to a significant increase in its incidence. Diabetics are particularly susceptible; local tissue changes, inadequate nutrition and unhygienic conditions may be predisposing factors. Coagulase-positive staphylococci are carried within the anterior nares or upon the skin of most healthy adults. Reservoirs of potentially virulent staphylococci exist in the air of hospitals. Newborn infants become nasal carriers within a few days. Such strains, when transmitted to patients with open wounds, or altered host-resistance, represent a serious danger, although less serious than those of the patient with an active infection. Work on penicillin-resistant strains of staphylococci demonstrates their adaptability to new environmental conditions produced by antimicrobials. This appears to assist in the colonization, in the nose and throat, of "hospital" staphylococci resistant to the usual antibiotics, these staphylococci moreover appearing to eliminate the sensitive strains. Staphylococcal bacteraemia, formerly more common in children than in adults, has decreased since the advent of antimicrobials; in adults it has remained stable, as has the mortality rate. The incidence of, and mortality rates in, staphylococcal pneumonia in adults, however, appear to have increased, strongly indicating that the staphylococcus has replaced the pneumococcus in producing terminal infection in patients receiving antimicrobial therapy. *Post-operative staphylococcal infection of wounds increased from 1 per cent in 1949* to 10 per cent in 1954, while wound culture revealed an increase in 4 years of 23·5 per cent [illegible]

advanced serious illness who acquire staphylococcal infections within the hospital under the umbrella of prophylactic antimicrobial therapy. In patients with acute infections due to drug-susceptible staphylococci, aqueous penicillin remains the drug of choice; in *combination with streptomycin, it possesses greater bactericidal activity.* In certain staphylococcal infections, erythromycin and chloramphenicol have been successful *The surgical drainage of local abscesses has given good results in patients not respon*ding to antimicrobials, and has important clinical implications in that the abscess formation probably precedes initiation of therapy in many infections and renders antimicrobials ineffective. Although antimicrobial-resistant strains constitute a serious problem, drug resistance alone has rarely been responsible for therapeutic failure. A more important factor is the basic disease on which staphylococcal infection is superimposed.

Resistant organisms and chemotherapeutic sensitivity

Problems in surgery

LINDER and SHOOTER (1956) discuss individually the problem of the resistant organisms and chemotherapeutic sensitivity in surgery. LINDER attributes the recent remarkable progress in surgery to improved anaesthetic methods, replacement of body fluids and electrolytes, and chemotherapy. Antibiotics have almost replaced operation in certain conditions, in others, they have reduced the operative risk. They are not, however, free from dangerous side-effects. While their toxic reactions are avoidable by strict dosage,

their allergic reactions range from mild skin rashes to death The non-specific side-effects include the increase in resistant organisms. The predominance of haemolytic *Staphy-*

effective. These drugs are also successful in resistant staphylococcal pneumonia. Pseudomembranous enterocolitis, although not entirely the result of antibiotic therapy, has increased with broad-spectrum antibiotics. It seems, therefore, that antibiotic therapy should be limited to certain indications. These include surgical or non-surgical wound

reviews staphylococcal infections. His experience with the former is presented as an example of resistance to treatment where the patient is responsible, infection due to organisms resistant to antibiotics is provided by the present position of hospital staphy-

probably erythromycin.

Novobiocin

Clinical and bacterial evaluation

PEARSON and her colleagues (1956) present a clinical and bacterial evaluation of novobiocin in 75 patients The methods of treatment are described. Among 20 patients

the other developed therapy fever and new abscesses. In both, increasing resistance to novobiocin was proved. A similar resistance after therapy for several months was found in 3 children with fibrocystic lung disease and recurrent staphylococcal pulmonary

Evaluation in Staphylococcus pyogenes *infections*

MARTIN and his colleagues (1956) [illegible]

[illegible] only between patient and patient but after each dose in the same patient. This concentration was therefore determined at 24-hour intervals for 12 days. Since these concentrations were not appreciably higher on the twelfth than on the first day, it was concluded that significant accumulation of the drug did not occur. Studies on the concentration in cerebrospinal fluid and blood serum of 9 patients without meningeal irritation demonstrated [illegible]

[illegible] excreted in the bile and was present in the thyroid tissues. Considerable quantities were excreted in the urine. In the faeces, the amounts excreted by patients receiving 5-days' administration were no greater than those receiving administration for 1 day. An inverse ratio may exist between the concentration in serum and in faeces. Further studies were made in a series of patients with staphylococcal infections In 5 of 7 cases of staphylococcal bacteraemia, novobiocin proved effective, in the remaining 2 cases, the supervention of allergic dermatitis and the development of antibiotic resistance necessitated withdrawal of the drug In 20 of 22 cases of infection of the skeletal system and soft tissues due to *Staph. pyogenes*, there was satisfactory clinical response. In 13 cases of staphylococcal enterocolitis, the flora of the stools reverted to normal and clinical improvement occurred within 24–72 hours. Eleven miscellaneous infections, including post-operative meningitis, [illegible]

[illegible] or haemopoietic system was observed. The possible deleterious action of novobiocin on the liver is being investigated.

Vancomycin

Laboratory and clinical experience

GERACI and his colleagues (1956) present laboratory and clinical experiences with vancomycin, a bactericidal antibiotic obtained from *Streptomyces orientalis*. It acts primarily against Gram positive bacteria and possesses low toxicity, bactericidal action at low concentrations and effectiveness against certain antibiotic-resistant micro-organisms Bacterial resistance towards it is slow and slight. It does not show cross [illegible]

[illegible] administration, faeces became almost odourless, clostridial organisms disappeared and *Streptococcus faecalis* was reduced or eliminated. Gram negative flora, however, persisted. The material and method used in the clinical studies is described. Vancomycin hydrochloride was given to 8 normal young men intravenously in single or multiple doses, or orally, in multiple 0 5 gramme doses. After injection, serum concentrations still averaged 0 7 microgram per millilitre after 24 hours. Urine concentrations were very high, suggesting excretion chiefly through the kidneys. There was no indication of diffusion through the normal meninges, even after multiple doses. Ready diffusion into the pleural fluid was shown, concentration being considerably higher after multiple doses. Variation in concentration in pericardial fluid suggested contamination with blood. In ascitic fluid, concentrations were higher after multiple injections than after one injection. Excellent concentrations were obtained in synovial fluid. The small quantities found in the bile suggest that vancomycin is not concentrated there. After oral administration, no vancomycin could be detected in the blood, except in one patient with

staphylococcal enterocolitis. Urinary excretion was small compared with that following a single intravenous injection, but large quantities were excreted in the faeces. Toxicity in 6 of 94 cases was confined to an occasional chill, dermatitis and minimal to severe localized phlebitis. The skin reactions in 1 patient consisted of pruritus with diffuse erythema, while 3 patients had a macular morbilliform eruption over the arms and thorax. No renal, haematological or hepatic toxicity occurred Vancomycin was admin-

REFERENCES

Alder, V. G., Gillespie, W. A., and Thompson, M. E. M. (1955) *J. Path. Bact.* 70, 503.

— Potter, J., and Wallace, K. R. (1955) *Ibid.*, **2**, 1087.

— — — (1957). *Ibid.*, **1**, 629.

— Mason, G A., Wallace, K. R., and Walton, M. (1955) *Ibid.*, **2**, 786.

Bourdillon, R. B , and Colebrook, L. (1946) *Lancet*, **1**, 561, 601.

— Lidwell, D. M , and Schuster, E. (1948) *Spec. Rep. Ser. med. Res. Coun. Lond.*, **262**, 12.

— McFarlan, A M., and Thomas, J. C. (1948). *Ibid.*, **262**, 241.

Bowie, J. H. (1955). *Pharm J.*, **174**, 473, 489.

Clarke, Suzanne K. R., Dalgleish, P. G , Parry, E. W., and Gillespie, W. A. (1954). *Lancet*, **1**, 211.

Cohn, J , and Longacre, A. B (1956–57) *Antibiotics Annual*, p 253 New York; Medical Encyclopedia Inc.

Colebrook, L. (1950) *British Surgical Practice*, Vol. 8, p. 145. London; Butterworth.

Cook, J., Elliot, C , Elliot-Smith, A., Frisby, B. R., and Gardner, A M N. (1957). *Brit. med. J.*, **1**, 542.

Cunliffe, A. C. (1949). *Lancet*, **2**, 411.

Devenish, E. A., and Miles, A. A. (1939). *Lancet*, **1**, 1088.

ntibiot. Chemother., **6**, 511

Esselier, A F., and Keith, J. (1956). *Schweiz. med Wschr.*, **86**, 1311.

Finland, M., Purcell, E. M , Wright, S. S , Love, B D , Jr., Mou, T. W , and Kass, E. H. (1954). *J. Amer med Ass*, **154**, 561.

Garrod, L. P. (1955). *Brit med J.*, **2**, 1529.

— (1956). *Brux med*, **36**, 2081.

— Shooter, R. A , and Curwen, M. P (1954). *Brit. med J.*, **2**, 1003.

Geraci, J. E , Heilman, F R., Nichols, D. R , Wellman, W. E., and Ross, G. T. (1956) *Proc. Mayo Clin.*, **31**, 564.

Gillespie, W. A , and Alder, V. G. (1957). *Lancet*, **1**, 632.

Girdlestone, G R., and Bourdillon, R. B. (1951) *Lancet*, **1**, 597.

Gould, J. C., and Allan, W. S. A. (1954). *Lancet*, 2, 988.
Gsell, O., and Kesselring, F. (1955). *Dtsch. med. Wschr.*, 80, 1218.
Hare, R., and Thomas, C. G. A. (1956). *Brit. med. J.*, 2, 840.
Hart, D. (1937). *Arch Surg.*, 34, 874.
— (1938). *Ibid.*, 37, 956.
Hasslinger, W. M. (1956). *Zbl. Chir.*, 81, 1566.
Howe, C. W. (1954). *New Engl. J. Med.*, 251, 411.
Howie, J. W , and Timbury, M. C. (1956). *Lancet*, 2, 669.
Leading article (1946) *Lancet*, 1, 613.
Lewis, G. W. (1957). *Brit. med. J.*, 1, 1153.
Linder, F (1957) *Proc. R. Soc. Med.*, 50, 153.
Lowbury, E. J. L (1954). *Lancet*, 1, 292.
McDermott, W. (1956). *Brit. med J.*, 2, 827.
McKittrick, L. S., and Wheelock, F. C. (1954). *Surg. Gynec. Obstet.*, 99, 376.
Marsh, F., and Rodway, Helen E (1954). *Lancet*, 1, 125.
Martin, W. J., Heilman, F. R., Nichols, D. R., Wellman, W. E., and Geraci, J. E. (1956). *J. Amer. med Ass.*, 162, 1150.
Matthias, J. Q , and Rees, E. G. (1956) *J. Path. Bact.*, 71, 512.
Pearson, Joyce Z., Somberg, A., Rosenthal, I., Leppen, M. H., Jackson, G. G., and Dowling, H. F. (1956). *Arch intern. Med.*, 98, 273.
Rogers, D. E. (1956). *Ann. intern. Med.*, 45, 748.
Rose, W., and Carless, A. (1910). *A Manual of Surgery*, 7th Ed., p. 268. London; Baillière, Tindall, and Cox.
Rountree, P. M., and Barbour, R. G. H. (1951). *J. Path. Bact.*, 63, 313.
— and Freeman, B. M. (1955). *Med J. Aust.*, 2, 157.
Scowen, E. F., Badenoch, A W., and Shooter, R. A. (1957). *J. Urol.*, 29, 140.
Shooter, R. A. (1957) *Proc R. Soc. Med*, 50, 158.
— Griffiths, J. D., Cook, Josephine, and Williams, R. E. O. (1957). *Brit. med. J.*, 1, 433.
— [illegible] 103, 257.
Siegentha [illegible] 74.
Smith, J. [illegible]
Sompolin [illegible] *t. Dis.*, 100, 1.
Spaulding, E. H., Tyson, R. R., Harris, Mary J., Jacobs, Barbara, Wildrick, L., and Johnson, K. O. (1956-57) *Antibiotics Annual*, p. 236 New York; Medical Encyclopedia Inc.
Tunevall, A., and Ericsson, A. (1954) *Antibiot. Chemother.*, 4, 886.
Walter, C. W. (1948). *The Aseptic Treatment of Wounds*, p. 20 New York; Macmillan.
Waring, H. J (1909) *Manual of Operative Surgery*, 3rd Ed , p. 13. London; Hodder and Stoughton
Wells, W. F., and Wells, Mildred W. (1936). *J. Amer. med. Ass.*, 107, 1698.
— — (1938). *Amer. J. publ. Hlth.*, 28, 343.
Williams, R. E. O. (1946). *J. Path. Bact.*, 58, 259.
— (1956). *Bull Hyg*, 31, 965.
Wright, Joyce, Cruickshank, R., and Gunn, W. (1944). *Brit. med J.*, 1, 611.
Wulff, H. (1953). *Acta chir. scand*, 105, 311.

THE ALIMENTARY SYSTEM

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ACUTE NECROTIZING ENTEROCOLITIS

Acute necrotizing enterocolitis has been recognized by pathologists for more than a century but only recently has it aroused the interest of clinicians While most authors have rightly emphasized the importance of this condition as a post-operative complication, especially after gastrectomy, it has also been described in association with a variety of non-surgical conditions of which heart disease is the commonest.

Clinical picture

In surgical cases the disease has an abrupt onset between the second and fifth day after operation The outstanding clinical feature is the rapid development of a state of profound shock which rarely responds to the most energetic measures designed to overcome it Diarrhoea of a choleriform type may be prominent but is not a constant feature Though gravely ill with a low or even unrecordable blood pressure, extensive cyanosis of the extremities, and oliguria or even anuria, the patient retains a striking mental alertness While abdominal signs are usually minimal, painful distension may occur and arouse suspicion of the existence of an intestinal obstruction or of a leak from an anastomosis

Pathology

The basic pathological lesion is a coagulative necrosis of the intestinal mucosa associated with thrombotic occlusion of the related capillaries and venules. Surface exudation, which has given origin to the synonym "pseudomembranous enterocolitis", is not a constant feature The changes may be limited to either the small or large bowel but may involve the entire length of the intestine and even affect the gastric mucosa At laparotomy there is usually a small amount of serosanguinous fluid in the peritoneal cavity and the bowel has a dusky, purplish appearance due to intense hyperaemia and stasis.

Aetiological theories

Shock

The cause of acute necrotizing enterocolitis is not known. It has been postulated that shock is the prime aetiological factor and that the necrotic lesions of the bowel wall result from prolonged hypotension during and after operation It is a matter of clinical experience, however, that enterocolitis frequently follows a technically simple gastrectomy in a patient whose condition remains excellent throughout the course of the operation and during the immediate post-operative period Shock is almost certainly the result rather than the cause of this complication.

Mucosal ischaemia

Mucosal ischaemia, with subsequent necrosis due to local vasomotor disturbances, has been suggested and the histological appearance of the bowel lesion is certainly consistent with this view. While it is now known that arteriovenous shunts capable of by-passing the mucosa are present in the bowel wall, the mechanisms operating these shunts are as yet obscure.

Infective hypothesis

The infective hypothesis has many adherents but even here there is disagreement. It has been suggested that there has been a real increase in the incidence of acute necrotizing enterocolitis since the introduction of the broad spectrum antibiotics, and, ascribing an aetiological role to resistant strains of enterotoxin-producing *Staphylococcus aureus*, the term "staphylococcal diarrhoea" has been advocated (Cook and his colleagues, 1957) It should be appreciated, however, that mucosal necrosis is not a feature of post-antibiotic diarrhoea and that, while staphylococci have been the predominant organisms in the bowel contents of some cases of necrotizing enterocolitis, this finding does not necessarily imply that they have caused the condition Moreover, this serious post-operative complication was known long before antibiotics were in use and still occurs in patients to whom these agents have not been given

Less attention seems to have been paid to the theory that the condition is due to infection by *Clostridium welchii*, ascending from its normal habitat in the lower reaches of the small intestine in the altered environment produced by ablation of acid-secreting gastric mucosa While it is true that *Cl. welchii* can be demonstrated in the gastric aspirate of some of these cases this organism has also been recovered from patients enjoying an uninterrupted convalescence. There is therefore no evidence that *Cl. welchii* is the real offender.

Prophylaxis

While it is evident that specific preventive measures are not presently available, it is strongly recommended that antibiotics should not be used as a routine prophylaxis in abdominal surgery. Bowel sterilization can be achieved satisfactorily and safely by means of the relatively insoluble sulphonamides, and many minor post-operative infections which run a mild or limited course do not warrant antibiotic therapy. These agents, if employed, should be discontinued as soon as possible.

Accepted surgical principles should be observed in the prevention of shock, dehydration and gastro-intestinal distension.

Treatment

Treatment of the established case of acute necrotizing enterocolitis must be instituted promptly and energetically. Even so, most cases terminate fatally. Fluids are given intravenously to replace the loss into the bowel. Ringer's solution is most suitable to compensate for loss of water and the specific electrolytes, but blood or plasma is required to meet protein loss Both noradrenaline and hydrocortisone are added to the transfusion fluid. Gastric aspiration should be instituted and characteristically it will be found that the aspirate consists of dark, offensive fluid. In view of the possibility that a resistant strain of *Staph. aureus* is responsible for the condition, all antibiotics should be stopped at once and erythromycin substituted.

The differential diagnosis between acute post-operative necrotizing enterocolitis and high intestinal obstruction may be exceedingly difficult: if the slightest doubt exists, laparotomy should be advised If an obstruction is found, the patient's life may be saved, but if enterocolitis is the cause of the shock-like state, it is unlikely that operation will influence the prognosis.

ANAEMIAS FOLLOWING GASTRO-INTESTINAL OPERATION

Surgeons are frequently called upon to treat lesions of the digestive tract which cause hypochromic anaemia, common examples are peptic ulceration, carcinoma of the stomach and haemorrhoids Not infrequently the surgeon, by operative alteration of the gastro-intestinal tract, produces conditions liable to result in anaemia which may be hypochromic or megaloblastic in type Thus hypochromic anaemia occurs commonly after partial gastrectomy while megaloblastic anaemia may follow total gastrectomy, entero-anastomosis and intestinal strictures

HYPOCHROMIC ANAEMIA AFTER PARTIAL GASTRECTOMY

Severe iron deficiency anaemia after gastric resection is almost confined to pre-menopausal women and to patients with recurrent ulceration, blood loss is the main factor in the production of the anaemia in both conditions.

Role of hydrochloric acid

The milder forms of post-gastrectomy anaemia were formerly attributed to impaired iron absorption in the presence of achlorhydria However, it has now been clearly demonstrated that even a high partial gastrectomy for duodenal ulcer rarely removes all acid-secreting gastric mucosa. Hydrochloric acid can usually be secreted in response to ordinary fractional test meals and almost always is evoked by employing the augmented histamine test Furthermore, iron deficiency is rare in Addisonian anaemia where histamine-fast achlorhydria is invariable It is therefore not surprising that hydrochloric acid is now regarded as playing a minor role in the mechanism of iron absorption. Nevertheless, the fact that some patients, particularly those with post-gastrectomy symptoms, tend to have deficient diets

must not be overlooked and it is possible that acid is of greater importance when iron intake is not much in excess of requirements.

Studies in iron balance

Loss of the duodenal loop and rapid transit down the upper reaches of the jejunum has also been held to explain the tendency to anaemia after partial gastrectomy There is now some evidence to support this view in that anaemia is more liable to follow the Polya than the Billroth I procedure. Contrary to this view is the evidence provided by the recent experiment of Mary Smith (1956) Iron balance studies made on patients who had had a gastrectomy, ferrous iron being labelled with 5 microcuries of ^{59}Fe, indicated little or no impairment of iron absorption Admittedly, the iron was given in the ferrous state in conjunction with ascorbic acid to fasting subjects—conditions which are ideal for absorption Similar studies should be made with food-iron labelled in a similar manner.

Blood loss

The views of Paulson and of Harvey (1954) supported by Witts (1956) that blood loss, from a recurrent ulcer, oozing from the region of suture lines, and bleeding from gastritis in the gastric remnant, explains most cases of anaemia is not supported by clinical experience. Thus gastroscopy performed on patients with symptoms after gastrectomy (the group liable to be on a restricted diet and to suffer from anaemia) commonly reveals a normal gastric mucosa free from erosions and from significant gastritis.

Anaemia due to deficient intake

In our view the milder forms of post-gastrectomy anaemia are related to deficient intake and should be treated by regular supplements of iron in the form of ferrous gluconate. The patients with severe hypochromic anaemia should have a full investigation to exclude blood loss, in women, the likely cause is excessive menstrual loss; in men, bleeding from recurrent ulceration or from a site unrelated to the operation must be sought and corrected.

MEGALOBLASTIC ANAEMIAS AFTER OPERATION

Aetiology

Megaloblastic anaemia is caused by a deficiency of vitamin B_{12} or of folic acid.

Vitamin B_{12} deficiency

Cyanocobalamin (vitamin B_{12}) is identical with the extrinsic factor postulated by Castle in his classic work on Addisonian anaemia Its absorption requires the presence of the intrinsic factor, which occurs in normal gastric juice but is absent in pernicious anaemia. In man, the intrinsic factor is secreted by the body gastric mucosa and in cases of pernicious anaemia a remission can be induced by the daily administration of as little as 10 millilitres of normal gastric juice. This very small requirement of gastric juice explains why even extensive subtotal gastric resection does not cause megaloblastic anaemia. The ability of the liver to store

vitamin B_{12} is very well developed, a fact which greatly simplifies treatment of anaemia since the vitamin can be injected in large doses and at long intervals.

Folic acid deficiency

Folic acid deficiency can arise from dietary lack but, in temperate regions, is more often due, as in the steatorrhoeas, to malabsorption from the small intestine. Deficiency of this factor arrests the normal maturation of the red cell series and gives rise to a megaloblastic bone marrow. In contrast to vitamin B_{12} deficiency, lesions of the nervous system are rare. There is very little storage of folic acid and daily dosage is required in treatment.

Total gastrectomy

The operation of total gastrectomy by removing the entire source of intrinsic factor might be expected to cause a megaloblastic anaemia. Due to the excellent stores in the liver of absorbed vitamin B_{12}, this type of anaemia is of rare occurrence within two years of operation but occurs commonly if the patient lives for more than three years. In practice megaloblastic anaemia is rarely seen as the operation is usually carried out for unfavourable carcinoma of the stomach, and extension of the tumour usually kills the patient within two years.

The clinical features are similar to those of pernicious anaemia and a few cases have even had lesions of the spinal cord An associated ariboflavinosis is frequently present. In cases not given prophylactic vitamin B_{12}, an early sign is the presence of a relatively high haemoglobin value with macrocytes in the peripheral blood and a megaloblastic bone marrow. Treatment with parenteral vitamin B_{12} effects cure in most patients though several cases have been recorded in which the addition of folic acid and iron were required to restore the blood picture to normal These factors may be poorly absorbed if there is diarrhoea, or they may be deficient in the diet of such patients.

Although haematologists enjoy the opportunity to study these anaemias, the surgeon should realize that lesions of the spinal cord may occur early and should institute prophylactic vitamin B_{12} therapy in all patients having a total gastrectomy.

The loop syndrome

The association of an Addisonian-like anaemia with intestinal stenosis and stagnant loops was discovered by Faber in 1895. Since then the syndrome has been found in cases of post-operative, tuberculous, and Crohn's strictures and after such operations as entero-enterostomy, ileocolostomy and after that surgical blunder—gastro-ileostomy.

The condition is predominantly the result of a vitamin B_{12} deficiency although there may also be a folic acid deficiency While, in most cases, intrinsic factor and hydrochloric acid are being produced by the stomach, studies with radioactive vitamin B_{12} have shown little or no absorption when the vitamin is given alone or even in combination with intrinsic factor After a few days on tetracycline, absorption is restored to normal In view of these findings Witts believes that stagnation leads to colonization of the intestine by abnormal bacteria which divert vitamin B_{12} and folic acid from the host for their own use.

The patient may present with abdominal symptoms—pain, excessive borborygmi and diarrhoea—with anaemia of the Addisonian type or with neurological symptoms In the early stages of the condition, relief can be obtained by antibiotics but cure depends on surgical correction of the mechanical lesion in the intestine. If the condition is allowed to persist, permanent changes in the intestinal mucosa may lead to irreversible intestinal insufficiency and the need for parenteral therapy for correction of the anaemia.

Gastrojejuno-colic fistula

In this condition, a sequel of recurrent ulceration after gastrojejunostomy, folds of jejunal mucosa act as a valve which tends to prevent food entering the colon while permitting colonic content to enter the stomach. It is for this reason that a barium enema is more satisfactory than a barium meal in revealing the defect on radiological examination. Irritation of the mucosa of the small intestine by bacteria leads to diarrhoea and impaired absorption of food and specific food factors. As with the loop syndrome, any resultant anaemia can be corrected by restoration of the normal anatomy of the gastro-intestinal tract by surgery. Proximal colostomy alone, by diversion of the faecal stream, will give great benefit and is now commonly employed as a first stage operation. In many cases, however, sufficient improvement follows intestinal chemotherapy to enable the operation to be performed as a single procedure.

CYTOLOGY IN THE DIAGNOSIS OF CANCER OF THE ALIMENTARY TRACT

The conception of cytopathology was first introduced more than 100 years ago by Pouchet who described vaginal smear changes during the menstrual cycle. Donaldson (1853) suggested the practical application of the technique to the diagnosis of cancer but, apart from isolated reports of tumour cells noted in a variety of secretions, the subject of cytology failed to attract the interest of clinicians. Awareness of its potentialities was aroused by the publication by Papanicolaou and Traut (1943) of their classic monograph on the diagnosis of uterine cancer by vaginal smear. This method of early cancer detection is now established practice in many gynaecological clinics and it appears that many cases of cervical cancer can be diagnosed in the absence of symptoms and of obvious signs. The possibility that a carcinoma *in situ* may fail to become an invasive cancer should, however, be borne in mind, lest extensive surgery or radiotherapy be needlessly advised. A controlled study of such cases in which an untreated group is carefully observed over a long period clearly requires to be made

Cytopathology is the study of altered morphology in shed cells; histopathology concerns the structural characteristics of cells in tissues. Material for cytological examination may be obtained by aspiration of secretions, by smears, scrapings, washings with saline solution alone or with the addition of mucolytic agents, and with the assistance of abrasive instruments to remove surface cells. The distinction between specimens removed by abrasive techniques and scrapings on the one hand and simple smear or washing techniques on the other is of importance. Cells

removed by abrasion retain their identity, do not show post-exfoliation changes and can usually be interpreted by a histopathologist; significant variations in exfoliated cells can be assessed reliably only by a person trained in this specialized field of pathology. Preparations may be examined in the unstained, unfixed state by phase contrast microscopy, a method which is of special value for the study of fine cytoplasmic structures. Staining methods are necessary for the examination of the nuclear chromatin. Of the many available stains, Papanicolaou's has the advantage of giving transparent smears even if the material contains mucus. It is therefore suitable for gastro-intestinal preparations.

Unless a department of cytopathology is available, visible or accessible lesions should be biopsied and the diagnosis established by accepted histopathological methods It is, therefore, our usual practice to obtain tissue in lesions of the oral cavity, oesophagus and lower reaches of the large bowel Selective gastroscopic biopsy has not so far been perfected, and it is in the diagnosis of the stomach and proximal colon cancers that exfoliative cytology may have its most obvious field of usefulness.

The oral cavity

Scrapings from an ulcer give a high degree of accuracy in the diagnosis of squamous-cell carcinoma, especially if the precaution is first taken to remove necrotic debris and pus As they are easily accessible, tumours of the mouth are well suited for observing the retrogressive changes induced by therapy Observations of this kind can be made from scrapings, thus obviating the disadvantage of serial biopsy.

The oesophagus

Specimens may be obtained by aspiration through an oesophageal tube, by centrifuging washings done during endoscopy or by abrasive techniques. The latter include the use of a fine-mesh gauge sponge and a retractable nylon whisk, either of which is readily incorporated in an oesophageal catheter The yield of positive diagnoses of tumour is high because the lesions are easily reached by either of these devices By the same token, biopsy is an equally safe and probably more certain diagnostic method The relative merits of cytodiagnosis and biopsy diagnosis in cancer of the oesophagus have not yet been critically assessed.

The stomach

Cytodiagnosis may have a place in the early detection of carcinoma of the stomach

A gastric ulcer on the distal third of the lesser curvature has a recognized, though small, risk of undergoing malignant transformation. Gastrectomy is therefore advised if symptoms are even moderately severe. When symptoms are mild the patient is kept under observation and a barium meal examination or [illegible] ytology is [illegible] ulcer.

[illegible] the patient who gives a history of weight loss, deterioration in appetite and vague dyspepsia and in whom clinical, barium and

gastroscopic examinations yield negative results In the absence of a reliabl pathological service, the further care of the patient resolves into a choice b careful re-examination at intervals or exploratory operation, and few surge prepared to advise the latter measure on such slender evidence. If it can be that the examination of cytological preparations will provide reliable assist this group of patients, a valuable contribution will have been made. Spe may be obtained by gastric washings or by use of the abrasive balloon. The of these methods have been described by Neiburgs (1956).

The evidence at present available suggests that errors in the cytodiagn gastric material are by no means unlikely. First, the cells present may not al from the gastric mucosa. Squames from the oral cavity, pharynx and oeso are commonly present and cells from the respiratory tract enter the stomac swallowed sputum Secondly, it is of importance to realize that exfoliated cell no infallible sign of malignancy. The cytopathologist therefore depen multiple signs of atypical cellular structure. False positive and false ne reports are almost certain to occur in any large series of cases. Thus Schade has stressed the risk of false positives in chronic atrophic gastritis and mucosal atrophy of pernicious anaemia

The time is ripe for a critical evaluation of the method in the diagnc carcinoma of the stomach.

The small intestine

Owing to the nature of the content of the small bowel, cellular material is r dissolved, satisfactory preparations are not obtainable and consequently li known of its cytology.

The colon

Lined with a single layer of high cylindrical epithelium, the cytological p of the colon is uniform. The material for examination is best obtained by c lavage using about 1 litre of Ringer solution Enemas are given 24 hours and 3 before the test wash-out Gross particles are removed for separate examin before centrifuging the return fluid and preparing smears from the res sediment.

In normal patients colonic lavage provides very few well-preserved cells. inflammatory disease results in a striking increase in cellular retrogressive cha Cancer cells from lesions of the caecum, ascending colon and transverse colo only be found in a very small percentage of proven cases. The accuracy of diag of cancer of the colon by cytological study is good in the lower reaches o large bowel but lesions at this level are, in the main, accessible to the sigmoido through which scrapings or biopsy can be taken.

Ascites

Aspiration of 20 millilitres of ascitic fluid provides sufficient sedimen cytological examination. The recognition of malignant cells is difficult. Ani tosis, multiple nuclei, inclusion of nuclear fragments and arrangement of ce clusters—usually regarded as characteristics of tumour cells—can occur norr

in the serosa. The most valid criteria of malignancy are frequent atypical mitoses and multiparity or clumping of chromosomes.

Conclusion

There is at the present time an undoubted wave of enthusiasm for exfoliative cytology as a means of detecting early malignancy. It is by no means as certain that enthusiasts are endeavouring to compare the accuracy of this technique with that of accepted diagnostic methods. Recovery of malignant cells from a proven lesion does not constitute an advance; recovery of malignant cells from the gastro-intestinal tract of the patient with a suggestive history but giving negative clinical, radiological and endoscopic findings is a triumph.

The desirability of scientific assessment is evident on medical grounds, it is also of importance on financial grounds. Cytopathology is a different discipline from histopathology and it is estimated that it takes at least a year to acquire the new outlook Staining-technicians and screening-technicians would also be required and, whereas the latter can be trained in three months if his work is devoted to one organ, for example, the cervix uteri, it takes about a year to train a cytologist capable of screening all types of material. The training of these technicians would inevitably make considerable demands on the time of the cytopathologist. It is to be hoped that the results of controlled experiment will precede the appearance of too many new departments of cytopathology.

ARGENTAFFINOMA

The occurrence of argentaffin tumours of the appendix or the small intestine has been recognized for a long time, but in recent years several interesting factors have come to light concerning their progress and effects, particularly in relation to their ability to secrete the amine 5-hydroxytryptamine.

Carcinoid tumour

Argentaffinoma or carcinoid tumour of the appendix presents as a small yellow [illegible]

the course of operations on the lower abdomen, and it does not recur after the appendix has been removed.

Argentaffinoma of the small intestine

This tumour is of similar histological character but differs in its growth and behaviour It grows slowly, but over a period of months or years it may attain considerable size, and by invading the substance of the wall of the intestine it may give rise to progressive degrees of chronic intestinal obstruction. In some cases it spreads to involve the mesenteric lymph nodes and forms metastases in the liver. The secondary masses, like the primary growth, are of only limited malignancy, and even the presence of massive growths in the liver is not inconsistent with many years' life and relatively good health

5-Hydroxytryptamine

In recent years much interest has been aroused by the discovery that in a proportion of cases the argentaffinoma secretes the hormone 5-hydroxytryptamine, which is responsible for several quite remarkable clinical effects, including attacks of diarrhoea, a peculiar brick-red coloration and flushing of the skin, and a tendency to stenosis of the pulmonary valve with right heart failure. These features are found only in cases with large metastases in lymph nodes or in the liver, and is not invariably present even in such circumstances.

5-Hydroxytryptamine or serotonin is normally produced in argyrophil cells which are present in the intestinal wall It is a derivative of tryptophane of dietary origin. There is some evidence to suggest that the tumour cells convert tryptophane to the intermediate stage of 5-hydroxytryptamine either in the tumour or in many other sites. Finally it is converted to 5-hydroxy-indole-acetic acid which is excreted in the urine.

5-Hydroxytryptamine is believed to exert important physiological functions, notably as a vasoconstrictor and stimulator of peristalsis. When secreted in excessive amounts in cases of argentaffinoma, it gives rise to the clinical features already mentioned, and in addition, by utilizing much of the available tryptophane, it may interfere with the production of nicotinic acid and thus predispose to vitamin B deficiency with pellagra.

It is not known why the continued excessive secretion of 5-hydroxytryptamine should lead to pulmonic stenosis. It is possible that continued constriction of the pulmonary vascular tree (a known effect of the hormone) may be a factor. In some cases a true pulmonic stenosis develops, with secondary heart failure.

The flushing and brick-red coloration of the skin form a noticeable feature of the syndrome, and indeed may be so marked as to attract attention to the tumour. It has been noted that the flushing is greatly aggravated by the ingestion of alcohol, perhaps due to the accumulation of aldehyde in the blood. In some cases the flushing is aggravated by administering histamine.

Diagnosis

The diagnosis of argentaffinoma should be borne in mind in any case of tumour involving the small intestine, particularly in the presence of extensive skin flushing or of evidence of pulmonary hypertension. Before operation the diagnosis can be confirmed (in hormone-secreting tumours) by demonstrating an excess of the breakdown product 5-hydroxy-indole-acetic acid in the urine. At operation, it is important to recognize that in view of the slow growth and limited malignancy of the tumour it may be worth while attempting a radical removal even in the presence of extensive lymph node involvement.

Indeed, even in the presence of liver involvement a palliative resection may be worth considering, with a view to mitigating or delaying the hormonal effects. Finally, in view of the very limited malignancy and slow growth, it is important to avoid a too pessimistic prognosis even where the disease appears to be far advanced.

ABSTRACTS RELATING TO THE ALIMENTARY SYSTEM

Oesophageal stricture

Surgical treatment

MacLean and Wangensteen (1956) write on the surgical treatment of oesophageal

ture, who have been treated by a surgical procedure designed to decrease acid-peptic irritation of the lower oesophagus are here reported on. Of these 15 underwent subtotal gastrectomy, and in 3 hiatal hernia repair accompanied by a Heineke-Mikulicz pyloro-

the size of the dilator which traverses the strictured area, increased *markedly* in the immediate and early post-operative period. Preliminary

lye or concentrated acid. stricture due to

Pyloric hypertrophy in adults

Laparotomy finding

congenital pyloric stenosis. cases.

One patient had suffered from migraine since childhood and a few patients had been subject to bilious attacks and vomiting. No tumour was palpated on clinical examination, but it was reported that in one instance the radiologist had palpated a tumour screening a case. Gross gastric retention was not encountered

established

tomy was performed

in cases of peptic ulcer. In one case a Ramstedt operation was carried out and in 4 cases a Heincke-Mikulicz pyloroplasty was employed. Post-operative convalescence was uneventful and every patient who remained under observation reported that the symptoms had been relieved Having regard to their findings, the authors advocate a Billroth I partial gastrectomy if a peptic ulcer is present or if there is a clinical history resembling that of peptic ulcer. If the diagnosis of pyloric hypertrophy in an adult is based mainl on radiological findings the authors recommend pyloroduodenotomy, biopsy and Heineke-Mikulicz pyloroplasty. In the differential diagnosis from carcinoma a sm incision should be made in the pylorus at laparotomy. The incision reveals white regu glistening muscle in pyloric hypertrophy and a grey irregular infiltrating growth in c cinoma. Biopsy is also of value in establishing the diagnosis.

Duodenal ulcer

Vagotomy combined with pyloroplasty or gastrojejunostomy

The results of an analysis of 366 cases of chronic duodenal ulceration treated by vagotomy combined with either gastrojejunostomy or pyloroplasty are presented by Davies (1956) The post-operative period has been 5 years or longer in most cases. The clinical results have been grouped in four grades: (1) 167 patients completely symptom-free; (2) 113 cases with mild symptoms causing no disability; (3 S) 19 cases with moderate symptoms not relieved by care, but with symptomatic and clinical improvement from the operation; (3 U) 11 patients who have moderate symptoms not relieved by care, in whom the clinical result was unsatisfactory, and (4) 20 cases not improved by operation. In the majority of patients weight had returned to normal and was steady. The figures in this respect compared favourably with weight levels after partial gastrectomy. Post-operative symptoms showed that 74 patients had diarrhoea, 67 complained of increased flatulence, and vomiting occurred in 44 cases; there was a total of 45 cases with hypoglycaemic attacks. Proved recurrent duodenal ulceration occurred only after vagotomy and pyloroplasty and its incidence was evenly divided through a 5-year follow-up period. Proved gastrojejunal ulceration occurring after vagotomy and short-circuit presented only during the first two post-operative years. There was insulin-test-meal evidence of incomplete vagotomy in 8 out of 9 patients with proved anastomotic or recurrent duodenal ulceration. A test-meal could not be arranged for the ninth. Gross delay in stomach emptying occurred in 2 of the 4 cases where gastric ulceration had taken place. There was no statistical difference between the total recurrence rate of 5·6 per cent following vagotomy and short-circuit, and that of 4·5 per cent following vagotomy and pyloroplasty (standard error = 2 4). There were 2 operative deaths after vagotomy and pyloroplasty and 3 after vagotomy and gastrojejunostomy. The 6 per cent incidence of gastric retention after vagotomy and pyloroplasty, as opposed to the absence of this complication following vagotomy and gastrojejunostomy, would indicate that pyloroplasty cannot be relied on as a gastric drainage procedure. It has also been found that post-operative symptoms after vagotomy and pyloroplasty are relatively more common than after vagotomy and gastrojejunostomy The clinical results in the series were as satisfactory in women as in men, and the evidence shows that vagotomy combined with gastrojejunostomy or pyloroplasty has a lower operative mortality rate than Polya partial gastrectomy.

Vagotomy and pyloroplasty

Weinberg and his colleagues (1956) report on the technique of vagotomy and pyloroplasty in the management of duodenal ulcer. The oesophageal hiatus is exposed, the peritoneum over the hiatus is incised and the lower part of the oesophagus is brought into view. The vagus nerves are identified A segment is removed from each nerve and any small nerve fibres in the vicinity of the exposed oesophagus are interrupted. The ulcer may fail to heal if the nerves are incompletely divided. The Heineke-Mikulicz procedure is adopted and the incision passes through the layers of the ventral pyloric wall. After inspection of the exposed mucosa for evidence of ulceration and palpation for evidence of constriction the pyloroduodenal incision is closed with a row of No. 50 cotton sutures spaced 3 millimetres apart, care being taken to exert traction in order to convert the

longitudinal wound into a transverse wound. Use of the Gambee stitch avoids infolding of the tissues. Eroded vessels are ligated by means of deep transfixion sutures. In most cases vagotomy is carried out prior to pyloroplasty. With regard to post-operative management, complications such as diarrhoea and retention are reduced to a minimum if gastric suction is maintained for 5 days and care is taken to restrict the diet. Two post-operative fatalities were recorded in a series of more than 500 operations Good results were obtained in 89 5 per cent of a group of 200 patients. Recurrence of ulceration occurred in 5 per cent of cases and post-operative sequelae were recorded in 5 5 per cent of cases The authors add that pyloroplasty is contra-indicated when the following conditions are present: (1) pyloroduodenal narrowing, (2) inflammatory oedema; and (3) dilatation of a low-hanging stomach

Peptic ulcer

Reversed gastrectomy

thes
pha
cur
a few cases difficulty arose since no pyloroplasty had been done. The results of this operation so far have been good The dumping syndrome has not been met and the patients are satisfied. Gastric capacity slowly increases and though patients do not gain weight they have sufficient energy.

Weight loss and malnutrition following surgery

SHINGLETON and his colleagues (1956) draw attention to the fact that many patients lose weight and suffer from malnutrition after undergoing operations for the relief of peptic ulcer Thus in 42 per cent of 864 cases of partial gastrectomy the pre-operative weight was never regained A weight analysis was made of 23 patients who had undergone vagotomy with gastro-enterostomy. It was found that 9 patients were below their pre-operative weight and 7 patients were below their ideal weight The authors report on studies of fat absorpt...
Within
adminis
venous
iodine in
of blood and faecal...

was not considered to be statistically significant. Radiological examinations were carried out 6 hours after the ingestion of the fat-barium meal, but the examinations revealed that no patient had abnormal retention of barium in the stomach Some patients showed large [illegible] of fat in the faeces, a finding which appeared to indicate a derangement in pan- [illegible] instances these patients were below normal weight and had [illegible] plained of fatigue and inability to perform [illegible] significance in determining [illegible] and strength.

[illegible]

Familial polyposis

Review of major surgical treatment

LOCKHART-MUMMERY, DUKES and BUSSEY (1956) review a series of 60 cases of familial polyposis treated by major surgery during the period 1918–54. Twenty-one cases were treated between these years. In this group excision of the rectum was employed in the management of 14 cases. Subtotal colectomy with anastomosis of the ileum to the rectum or sigmoid colon was performed in 4 cases and partial resection of the colon with a Paul-Mikulicz anastomosis was performed in 3 cases. The operative mortality was 23 per cent, and in 6 cases another primary tumour developed in the remaining bowel. After the year 1945 the majority of patients were treated by means of total colectomy with anastomosis of the ileum to the rectal segment. Usually the anastomosis was effected at a point about 12 centimetres from the anal verge. Diathermy coagulation was employed in the treatment of rectal polyps, thereby ensuring that the ileum was anastomosed to bowel free from disease The incidence of malignant change was 35 9 per cent, as compared with 52 4 per cent in the first series of cases This improvement was attributed to earlier treatment and to the special effort which was made in order to trace the relatives of patients with polyposis. After ileorectal anastomosis 26 of 29 patients made satisfactory progress. Most patients had 2 or 3 bowel actions daily, but no urgency of defaecation. These patients required constant supervision, however, for the detection and treatment of newly formed benign polyps. The authors record the case of an apparently healthy woman, aged 31 years, with a family history of polyposis. Sigmoidoscopy was carried out and a few adenomatous polyps were seen in the rectum Barium enema examination revealed an obstruction in the colon An operation was performed and a large villous papilloma was removed from the splenic flexure The tumour was found to contain a small focus of carcinoma.

Ulcerative colitis

Surgical management

HILL, STONE and PEARSON (1956) write on the surgical aspects of ulcerative colitis. Improved medical management has made urgent operation for the control of acute exacerbations of the disease less frequent, but surgery remains the only therapy for patients with active, though chronic, colitis. More instances of carcinoma are being reported in patients who live longer with ulcerative colitis; and intractability and risk of malignancy are emphatic indications for surgery. Surgical management has shown progressive improvement, with a trend to performing total colectomy or proctocolectomy in a single stage. The authors review 10 cases on whom single-stage proctocolectomy was performed. The patients were carefully selected, with two exceptions with massive haemorrhage, when the whole colon and rectum were removed at a single stage to stop haemorrhage. One survived and the other was the single mortality in the group. The simplified method of the operation allows of the elimination of the perineal part of the procedure by the removal of the entire colon and rectum through an abdominal incision. After anaesthetization, a gauze roll 6 inches long and saturated with benzalkonium (Zephiran) is inserted into the rectum. To facilitate removal an umbilical tape is attached to the pack. A left paramedian incision is made and a site selected for division of the ileum, usually 8 inches from the ileocoecal valve The entire colon is then removed in the conventional manner down to the recto-sigmoid At this point the bowel is divided, and the colon specimen removed If a one-

Surgical treatment

dissection the operation was performed in 2 stages, either by primary colectomy and rectal excision or by ileostomy and panproctocolectomy. Nine patients were treated by means of resection and anastomosis, with preservation of the anal sphincters. This pro-

tions included colo-ileitis, ano-rectal lesions, perforation, haemorrhage and carcinoma Secondary ileitis was attributed to reflux through an incompetent ileo-caecal valve The function of the small bowel was not impaired and steatorrhoea was never observed Extension of the disease into the ileum was not a specific feature of long-standing ulcerative colitis. Fissure was a common anal complication and it resulted from an extension of ulceration across the ano-rectal ring Fulminating disease was encountered in 13 patients. This condition was characterized by severe toxaemia, pyrexia and lethargy. As for remote complications, arthritis developed in 17 cases. The large joints were affected, especially

Obstruction of colon

Treatment

CAMPBELL, [illegible]
obstruction of [illegible]
volvulus. In 9 [illegible]
incidence of ot[illegible]
tumours were [illegible]

authors are of the opinion that surgery should be employed in the management of acute obstruction of the colon, for conservative treatment causes useless delay In the first instance the large bowel should be decompressed, elective resection should be employed

later on. Resection should only rarely be carried out when acute obstruction of the colon is present. The Paul-Mikulicz method is often a difficult procedure and its results may prove to be inadequate. It should be used in the treatment of obstruction due to carcinoma of the transverse colon but only if the mesocolon is long and the tumour can be lifted out easily. Ileo-transverse colostomy is the procedure of choice for carcinomatous obstruction of the right half of the colon. Caecostomy is carried out if the ileo-caecal valve is competent or if the patient is very ill. If necessary the operation is performed under local anaesthesia. For malignant lesions of the left half of the colon either transverse colostomy or caecostomy may be employed. As for the management of [illegible] bowel is gangrenous.

Carcinoma of the colon

Problems of treatment

Some of the problems connected with carcinoma of the colon are discussed by RAVDIN (1956) This lesion often develops from the fairly common adenomatous polyps which are often hereditary. Some surgeons, dealing with cancer of this kind, attach much importance to a good anatomical result and recovery from operation, others are more concerned that recovery should me[illegible]. An adequate resection of the bowel and adjacent mesentery is still thought [illegible] operation is correct the amount to [illegible] are frequent variations in the blood supply of the parts. Cancer of the large bowel and rectum accounts for the greatest proportion of all these growths in man; three-quarters are found within 26 centimetres of the anus and most arise from adenomatous polyps. There is no essential difference between those that are congenital and those arising from other factors. It is only when acute obstruction is found that a two-stage operation is needed, and when this obtains a proximal colostomy is the first requirement. Caecostomy should not be used as a routine If there is no acute obstruction then the wise use of a [illegible] one stage [illegible] the whole of this and part of the transverse colon should be taken away. It is rarely possible and truly not essential to attempt covering the bare peritoneal wall with peritoneum, in general end-to-end anastomosis is the best In the transverse colon lymph [illegible] that here also wide resection is needed. This [illegible] c artery. [illegible] ore pre- [illegible] no inter- [illegible] oidance of manipulative venous spread, implantation and the eradication of all growth.

Carcinoma of large intestine

Review of treatment and operative mortality

[illegible] mortality of car- [illegible] General [illegible] 76·2 per [illegible] of carcinoma of the rectum and sigmoid col [illegible] was largely due to the use of antibiotics and [illegible] balance. These factors were also related to improvement in the results of emergency operations in cases complicated by acute intestinal obstruction. In this context, however,

another factor was the greater use of transverse colostomy as compared with caecostomy in the management of obstructed growths of the left colon. Perforation of the colon, associated with peritonitis, resulted in a high mortality in both series of cases. Examination of the data relating to the sex incidence in the combined series revealed a slight preponderance of cancer of the large intestine among males. This preponderance was attributed to the greater incidence of cancer of the rectum among males than among females. Carcinoma of the rectum was present in 57 4 per cent of cases and half the number of growths in the colon affected the sigmoid region Evidently malignant disease of the large bowel is more likely to occur distally. In fact, four-fifths of patients with bowel cancer have lesions which can usually be palpated by the finger or located by the sigmoidoscope.

Prolapse of rectum

Mechanism and treatment

Prolapse of the rectum is discussed by MILLS and LAWLER (1956), who observed that it is really a sliding hernia with a definite sac and hernial orifice. Weakening and laxity of the levatores ani and other structures predispose to the prolapse so that the opening in the pelvic diaphragm is enlarged. It is noted that, after reduction, pressure anteriorly in the anal canal will control the prolapse, even with the patient straining. Repair of the hernia is made difficult by the varying size of the rectum and the impossibility of securing rest for the parts involved. Good results are only possible when the tone of the anal sphincter is restored after it has been grossly dilated. The numerous operations used for the condition indicate its difficulty. The most popular procedure is really a rectosigmoidectomy, the prolapse being divided below the anus, the excess peritoneal sac is resected and closed, the rectum is pulled downward until all slack is taken up and end-to-end anastomosis is made between the rectosigmoid and the anal canal When completed the line of junction is just inside the anus. Stricture formation and recurrence are not rare. Some surgeons use an abdominal approach, attempting, in general, to tighten up the pelvic floor and fix the slack gut at a higher level while excising redundant peritoneum in the hernial sac. The writer considers that the first step to success is to fix the [illegible]

[illegible] is strongly emphasized. The patient gets up after a week and leaves hospital after 2 or 3 weeks, the colostomy being closed in 3–6 months, depending on the size of the prolapse. In a series of 8 cases the results have been good

Haemorrhoids

Anatomy of anal region

[illegible]

margin there is a gradual transition from true skin to stratified squamous epithelium. This junction, termed the squamous border, overlies the lowest fibres of the internal [illegible]

of haemorrhoids. The anal mucosa prolapses and fails to return spontaneously. The superior and inferior haemorrhoidal veins become free to anastomose and the marginal veins dilate As for the treatment of haemorrhoids, surgery offers the only hope of cure if the mucosal ligament has been stretched. In the operation of submucous haemorrhoidectomy an attempt is made to avoid pain by the use of high ligatures which do not incorporate the mucous membrane. The dilated veins are removed and the superior haemorrhoidal arteries are ligated above the ano-rectal ring. The anal muscle is attached to the underlying muscle. It is of importance that sufficient fibrous tissue should be produced to ensure prevention of prolapse and also of venous distension of the submucous space. Mucosal flaps are provided for covering denuded areas Tubes and packs are not used. Early healing of the wound is essential in order to avoid spasm, stricture and fissure. Parks reviews a series of 50 [illegible] was performed In this series haemorrh[illegible] returned to normal life within 14 days of [illegible] 6 cases, but with increased experience the incidence of this condition was reduced.

The biliary tract

Surgical considerations

CATTELL and WARREN (1956) discuss the surgery of the biliary tract. They observe that stenosis of the sphincter of Oddi as a factor in disease is being more and more accepted Thus, in operations on the biliary tract, if the sphincter is dilated at the time of operation, recurrence of biliary symptoms is less frequent than when this is omitted. Fibrosis round the sphincter is not thought to be due to stone in the common duct or to previous operative interference with the distal end of that duct If a 3-millimetre [illegible]r into the duodenum an organic obstruc[illegible]ive procedures are used to overcome the [illegible] not be carried out indiscriminately the mortality is not high. Operative cholangiography is most useful if performed by those who use it frequently close co-operation of surgeon and radiologist being essential. If there is any stricture of the common bile-duct it arises most often from antecedent cholecystectomy, *the number of times the duct is injured being much too high.* Retrograde [illegible] with more [illegible] and need careful study. Marked loss of weight and some jaundice are common with strictures of the duct. A high calorie intake and careful preparation for operation will reduce mortality and complications and vitamin K should be given intramuscularly. An external biliary fistula rather than definite repair may be unavoidable at first. *Portal* [illegible] of the common duct but it is increasingly [illegible] temporary [illegible] solution

Chronic cholecystitis

Report on surgical treatment

[illegible] received surgical [illegible] ones [illegible] story [illegible] nd 31

for the outcome of surgical treatment, no improvement was recorded in 24 per cent of cases There were 22 major complications and 3 fatalities. The deaths were attributed to

Acute pancreatitis

Natural history

KADEN and HOWARD (1956) have investigated the natural history of acute pancreatitis. A study was made of 100 consecutive surviving patients who had been treated for acute pancreatitis, the cases were followed up for an average period of 3–5 years. The diagnosis was based primarily on the clinical syndrome supported by an elevated serum amylase concentration, and in a few cases it was based on the findings at laparotomy Treatment

terrupts the course of the pancreatic disease, suggesting that the pancreatitis is secondary to the organic biliary tract disease The second syndrome, which frequently follows chronic alcoholism, is not associated with biliary tract disease, and results more often in

cases with gall-stones but not in other cases

Chronic relapsing pancreatitis

Radical resection of pancreas

LONGMIRE, JORDAN and BRIGGS (1956) give an account of the use of radical resection of the pancreas in the treatment of 8 male patients suffering from chronic relapsing pancreatitis The patients were in the age-range of 34–63 years The investigators carried out

sphincter of Oddi. The patient's condition improved for about 12 months. Subsequently, however, the patient began to lose weight and to suffer from severe pain in the left upper quadrant of the abdomen. On examination of the abdomen it was thought that a mass could be palpated in the left upper quadrant. There was an increase in the fat content of the stools. Laparotomy revealed generalized pancreatitis with erosion of the spleen and haemorrhage. A few months after an operation in which the spleen and part of the pancreas were removed a second operation was required. Pancreatico-duodenectomy was performed. The patient made a satisfactory recovery, but later on it was reported that the patient had died, possibly from a complication of diabetes mellitus *It is pointed out that* diabetes presents a special problem in cases of total pancreatectomy. As for the control of diabetes, the most difficult period begins when the patient begins to take food by mouth. The use of a direct surgical procedure is indicated when a patient with chronic

with pancreatico-duodenectomy and total pancreatectomy poor results are achieved with indirect surgical procedures such as sphincterotomy and choledochostomy. When 14 indirect surgical manoeuvres were employed in the treatment of 26 cases of chronic relapsing pancreatitis favourable effects were obtained in only 3 cases.

Portal hypertension associated with massive gastro-intestinal bleeding

Experimental and clinical findings

McDermott, Wareham and Riddell (*1956*) record *68* fatalities in *118* cases of portal

bleeding. Death was attributed to

d in coma without having shown

hage. Evidently blood loss alone

text the authors investigated the

tract in the presence of portal-systemic shunts. The experimental and clinical findings indicated that sudden massive haemorrhage from oesophageal varices could give rise to ammonia intoxication. Experiments were performed on normal dogs and on dogs with Eck fistulas. Blood was introduced into the gastro-intestinal tract and measurements were made of the amount of ammonia and urea nitroge

the amount of blood urea

ammonia level. The dogs

nitrogen, but to a less extent. On the other hand, these dogs showed a great increase in the amount of blood ammonia. With the introduction of further quantities of blood into the stomach the dogs with Eck fistulas began to suffer from symptoms referable to disease

in the gastro-intestinal tract, thereby controlling the formation of urease and

acid oxidase.

REFERENCES

Brooke, B N (1956) *Lancet*, **2**, 532.
Campbell, J. A, Gunn, A. A, and McLaren, J F. (1956) *J. R. Coll. Surg., Edinb.*, **1**, 231.
Cattell, R. B., and Warren, K. W. (1956). *New. Engl. J Med.*, **255**, 761.
Cook, J, Elliott, C., Elliot-Smith, A., Frisby, B R., and Gardner, A. M N. (1957) *Brit med. J.*, **1**, 542
Davies, J A. Ll. (1956). *Brit. med. J.*, **2**, 1086
Deloyers, L. (1956). *Ann. R. Coll. Surg. Engl.*, **18**, 277.

Desmond, A. M., and [illegible]

72, 968

[illegible] *Brit J. Surg*, 43, 476.
Longmire, W. P., Jnr., Jordan P. H Jnr and Briggs, J. D. (1956). *Ann. Surg.*, 144, 681
McDermott, W. V., Jnr., [illegible]
MacLean, Ll. D., and W. [illegible]
Mills, J. D, and Lawler, [illegible]
Neiburgs, H. E. (1956). [illegible] Stratton, [illegible]
Papanicolaou, G. N., and Traut, H. F. (1943). "Diagnosis of Uterine Cancer by the Vaginal Smear". New York, The Commonwealth Fund.
Parks, A G. (1956) *Brit J. Surg*, 43, 337.
Paulson, M, and Harvey, J. C. (1954) *J. Amer. med Ass*, 156, 1556
Ravdin, I. S. (1956). *Surg. Gynec. Obstet.*, 102, 257.
Schade, R. O. K. (1956). *Gastroenterologia, Basel*, 85, 190.
Shingleton, W. W., Baylin, G. J., Isley, J. K., Sanders, A. P., and Ruffin, J M (1956). *Ann. Surg.*, 144, 433.
Smiddy, F. G., and Goligher, J. C (1957). *Brit. med. J.*, 1, 793.
Smith, Mary D (1956). *Proc. R. Soc Med*, 49, 868.
Weinberg, J A., Stempien, S. J., Movius, H. J., and Dagradi, A E (1956). *Amer. J. Surg.*, 92, 202.
Witts, L. J. (1956). *Anaemia and the Alimentary Tract*. Sydney Watson Smith Lecture, 1955 Royal College of Physicians, Edinburgh.

PROGRESS IN PULMONARY SURGERY

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LUNG RESECTION FOR PULMONARY TUBERCULOSIS

The introduction in 1948 of streptomycin and later of para-aminosalicylic acid (P.A.S.) and isonicotinic acid hydrazide (I.N.A.H.) has altered the whole approach to the surgical treatment of pulmonary tuberculosis. Before chemotherapy came into regular use, the standard surgical method of treatment was the operation of thoracoplasty. Various modifications were employed from time to time in order to try to increase the scope of the operation and to make it safer. Resection, at this time, was occasionally carried out accidentally, usually with unfavourable results The first impact of chemotherapy was extremely important in that, used as a cover for resections, it enabled these to be carried out with relative safety. In 1948 the first cases were operated on, and during the succeeding 10 years the whole attitude towards surgical treatment in pulmonary tuberculosis has changed radically, so that, at the present time, a resection is regarded as the operation of choice, and thoracoplasty and its modifications are used only when resection is contra-indicated for one reason or another.

Chemotherapy has also affected other forms of treatment not necessarily regarded as the province of the surgeon Artificial pneumothorax and artificial pneumoperitoneum with or without phrenic paralysis are only very occasionally used, and division of adhesions in an artificial pneumothorax is very rarely practised. Chemotherapy has, however, had other significant effects upon surgical management. Knowledge of its effective use has increased over the years and benefits of more prolonged courses of a combination of drugs has led to a better control of the active element of the disease, so that surgery has been more and more concerned with treating the sequelae of the original disease. Long-term chemotherapy [illegible]

[illegible]

in the numbers of new cases. All these factors have led to a considerable falling off of the demands for surgical treatment. Chemotherapy has, however, produced problems of its own, the most formidable of which is the emergence of resistant strains of tubercle bacilli. The investigations of the Medical Research Council (1955) indicate that it is essential to administer the antibiotics regularly in combinations of two or more. Unfortunately, in the past, single drugs were often administered for long periods, or a combination of drugs was wrongly exhibited so that a number of long-standing cases are now resistant to the three main drugs. This not only means that the powerful weapon of chemotherapy is denied them but also that surgery, if it is carried out at all, is more hazardous

Advantages of resection

The advantages of resection over other forms of surgical treatment are.

(1) The removal of the more obvious and potentially dangerous tuberculous [illegible]

lung appears to be no exception to this general rule.

(2) Pathological investigations of resected specimens indicate that, even after fairly prolonged periods of chemotherapy, viable tubercle bacilli can be found in walled-off caseous foci. Removal of these infected foci renders the chance of subsequent break-down and reactivation less likely (Todd, Teare and Gordon, 1956).

(3) The removal of the diseased lobes or segments impairs the function of the remaining lung tissue relatively little (Fleming, 1957) This contrasts with the operation of thoracoplasty which, by its very nature, must collapse a certain amount of normal lung tissue in addition to the diseased area

(4) Resection does not carry the hazard of unclosed cavities or residual bronchiectasis which may occur after thoracoplasty

(5) Resection has the advantage of adequately treating conditions where the diagnosis is uncertain. A rounded shadow, for instance, although suspected as being tuberculous, might possibly be neoplastic so that its removal is of fundamental importance to the patient. This particular aspect of the problem is becoming more important owing to the increasing incidence of lung cancer in all age groups and also because more middle-age males appear to be developing pulmonary tuberculosis It is men in this group particularly who are more liable to develop cancer.

Disadvantages of resection

The potential disadvantages of resection must, however, be considered.

(1) Although the post-operative complications are not great, they are, on the whole, more serious than for a thoracoplasty. The occurrence of a bronchopleural fistula and of an empyema carry a definite morbidity and mortality rate; there are no comparable complications with thoracoplasty.

(2) The removal of a lobe or a lung creates a problem regarding the obliteration of the dead space formerly occupied by the resected organ If this space is small and the surrounding lung is normal then the latter can be relied on to expand to fill the space, but if the space is large or the surrounding lung is diseased, then

steps must be taken to reduce the space surgically. In the case of an upper lobe, this usually implies the performance of a small thoracoplasty. In the case of a lower lobe it can be done by elevating the diaphragm, whilst in the case of a whole lung a fairly extensive thoracoplasty may be required. Bickford and his colleagues (1957) maintain that space reduction significantly reduces the chances of subsequent reactivation of the disease and therefore recommend its performance in the majority of their patients.

(3) Alveolar leakage of air is a not infrequent complication and may prevent the normal lung from expanding properly and may leave a space which could become infected In these cases, a secondary thoracoplasty is often required to close the space.

(4) In border-line cases, the surgeon may be driven to remove more lung than was intended because of the finding of disease more extensive than anticipated. In such cases there is a risk of producing respiratory crippling.

(5) If inadequately controlled disease is left behind in a lung which has over-expanded in order to fill the gap, there is a risk that this over-distension may lead to renewed activity of dormant foci.

Indications for resection

The indications for resection can be considered under three headings, namely absolute and relative indications for resection and the contra-indications.

Absolute indications

Solid tuberculous lesions.—These comprise tuberculous foci which are more than 2 centimetres in diameter. Pathologically they may consist of an area of caseous pneumonia, or a tuberculous cavity filled with caseous material. A few are examples of a bronchial cold abscess where caseous material is trapped behind a stenosed segmental or subsegmental bronchus. These large tuberculous foci are rarely cured, even by prolonged chemotherapy, and pathological examination of the resected specimen frequently reveals the presence of tubercle bacilli. In some instances, a firm pre-operative diagnosis cannot be made and a cancer cannot be excluded with certainty.

Failure of medical treatment.—The persistence of a positive sputum or a cavity after 6 months of adequate rest and chemotherapy is regarded by the majority of [illegible] [illegible] suitable for resection.

Lesions associated with stenosis of the larger bronchi.—Pulmonary tuberculosis is a generalized disease with lesions occurring in the lung, the pleura, the bronchial walls and the lymph nodes Not infrequently the larger bronchi are destroyed with the production of either gross bronchial dilatation or a stricture. Collapse therapy in these cases has little effect on the bronchial lesion These lesions remain to give rise to later symptoms of recurrent infection or haemoptysis The condition of the bronchial tree should be determined by bronchography in most cases where surgery is contemplated, as the presence of severe residual bronchial damage constitutes a good indication for resection provided there are no other contra-indications.

Lower lobe disease.—For anatomical reasons, tuberculous lesions in the lower lobe are particularly difficult to control by collapse therapy such as thoracoplasty or its modifications. Phrenic paralysis and a pneumoperitoneum, although theoretically ideal, are only effective in about half the cases: resection, therefore, has an obvious advantage in such cases.

Failure of collapse therapy.—With the failure of a thoracoplasty or its modifications to close a tuberculous cavity after a reasonable interval of time, further treatment is necessary In such cases, resection has obvious advantages over a further extension of the thoracoplasty which is often the only other alternative.

Destroyed lobe or lung.—Extensive disease throughout a lobe or lung may result in complete destruction of normal lung tissue usually combined with equally damaging lesions in the bronchial tubes. Although collapse therapy may well lead to a satisfactory arrest of the disease, there are obvious advantages in excising the involved area if the latter is practicable

Relative indications

In this group there is perhaps less uniformity of opinion about the needs for surgical treatment or for resection if surgical treatment is considered advisable.

Residual nodules.—After a period of chemotherapy, small nodules of up to 1 centimetre in diameter may remain. These may be sterilized completely by chemotherapy and thus rendered safe, but pathological investigations indicate that some still contain tubercle bacilli. Investigations by Stewart, Turnbull and MacGregor (1956) indicate that with chemotherapy of over 12 months' duration the chance of viable bacilli remaining in the lesions are considerably reduced. At the present time, there is no uniformity of opinion about the need for removing such nodules some are removed, others are left, and no final answer is likely to be available for some years Generally speaking, residual nodules of over 1 centimetre in diameter are probably best removed, particularly when these nodules are limited to a small area of lung.

Residual "cysts".—Prolonged chemotherapy for cavitated disease not infrequently results in residual thin-walled cyst-like cavities. These, at first glance, would appear to be healed lesions but careful pathological studies by Keers, Riddell and Reid (1956) show that small, potentially active foci of tuberculous disease remain in the walls and it must be assumed that in these instances, reactivation of the disease is a possibility, and their removal is therefore desirable.

Contra-indications

The contra-indications to resection have been steadily reduced with advancing knowledge, greater surgical experience and a more widespread and prolonged use of chemotherapy. In many instances, the contra-indications are temporary and not permanent.

(1) The presence of extensive disease and particularly bilateral disease where a resection would not remove the greater part of the disease either in one or two operations constitutes a recognized contra-indication to resection. The risks of exacerbation are too great, and in such cases it is perhaps wiser to effect a temporary control of part of the disease by collapse therapy and at a later date turn to resection if residual disease remains.

(2) The presence of active tuberculous endobronchitis, as shown at bronchoscopy, demands that a resection should be deferred until such disease has been arrested. Division and suture of an infected bronchus is likely to result in a bronchopleural fistula and an empyema with unhappy results. In such cases, a further period of chemotherapy is required.

(3) The results of resection in the presence of an open cavity with tubercle bacilli present in the sputum have shown a slight, but definite, increase in the complication rate, and it is now generally accepted that chemotherapy ideally should be continued until the sputum no longer contains tubercle bacilli.

(4) The presence of other pulmonary diseases, particularly chronic bronchitis, emphysema, asthma and pneumoconiosis adds considerably to the hazards of resection; other methods of treatment are preferable in such cases

(5) Finally, there is the question of drug sensitivity of the organisms. We have already mentioned that the presence of organisms which are resistant to the three major drugs does increase the chances of serious complications, and here again, caution should be urged if resections are contemplated.

Pre-operative preparation

Much has already been said about the preparation for surgery. Investigations should be designed to indicate the full extent of the disease, and in this connexion, lateral tomography and bronchography deserve special mention. Bronchoscopy should be carried out if endobronchial disease is suspected on clinical or radiological grounds. All patients should have had a fairly prolonged period of chemotherapy before surgery is undertaken, and the majority of surgeons agree that at least 6 months of such treatment is required. Immediately prior to operation, breathing exercises should be carried out in order to improve function.

Anaesthesia

The operation is carried out under general anaesthesia using the standard thoracotomy incision If secretions are at all extensive, steps should be taken to control them either by the use of an endobronchial balloon or by carrying out the operation in the prone position.

Only the principles of the operation need be considered here. It should aim at removal of the gross disease in the affected lung but every attempt should be made to conserve as much normal, or relatively normal, lung tissue as possible. The operation should be carried out in an anatomical manner, removing either a segment, a lobe or a lung, and carrying out the removal in an anatomical plane. Adherent areas of the lung to the chest wall should be removed together with the parietal pleura in order that tuberculous tissue is not transgressed. Every attempt should be made to avoid contamination of the pleural cavity by infected material. The bronchus should be divided flush with the parent stem and its closure should be carried out carefully and deliberately. Raw lung surfaces may be covered by pleural flaps or by suturing the edges to adjacent lung but such is not an essential part of the procedure. Streptomycin powder is usually applied to the bronchial stump and the latter may be covered by a pleural flap, a pedicled intercostal muscle graft or left uncovered according to the custom of the surgeon.

Post-operative period

The success or failure of the operation is largely dependent upon the post-operative management. All cases should have the pleural cavity drained by one or more tubes; if two are used, one is placed at the apex of the thoracic cavity and is designed for the removal of air, whilst the other is sited at the base and serves to remove fluid. Suction drainage is employed by many and serves to maintain full expansion of the remaining lung which is the main secret of success.

Early radiography is desirable to ensure that the lung is fully expanded at an early stage; if this has not taken place, steps should be taken immediately to ensure that it is achieved Nursing the patient with the operated side uppermost, lying flat with a pillow in the opposite axilla, or in a specially made plaster cast will help considerably with the full expansion of the operated lung. Tube drainage is required for several days until there is no further leakage of air or fluid Confinement to bed is generally practised for 6 weeks after the operation followed by slow rehabilitation. Chemotherapy after operation is carried out for a considerable time, in many cases for 18 months or more.

Post-operative complications

Tracheobronchial secretions

Excessive secretions provide the most important problem in the first few days after operation Training in coughing pre-operatively helps considerably. Much depends upon the efficiency and encouragement of physiotherapists and nursing staff in helping the patient to expectorate secretions If, however, secretions cannot be removed by natural means they must be removed either by catheter suction or by bronchoscopy, but if, in spite of these measures, secretions continue to accumulate, then tracheostomy should be performed without delay: this latter procedure is extremely important, particularly if the presence of secretions result in ventilatory difficulties. The presence of a tracheostomy enables repeated catheter suction to be carried out with a minimum disturbance of the patient, and the reduction of dead space air improves the efficiency of ventilation A tracheostomy can be performed in the ward without difficulty and its performance should not be deferred until the patient is in extremis

Atelectasis

Lobar or [illegible] accumulated secretions and may res[illegible] ion The lobe can often be made to [illegible] but should success not ensue after a short period, bronchoscopy should be carried out without delay because the risks of more serious complications are considerable.

Bronchopleural fistulae

After any resection, leakage of air from the lung surface is almost universal, but these alveolar leaks usually cease after a few days and do not prevent full expansion of the lung or result in infection of the pleural cavity A bronchopleural fistula, however, is a more important and serious complication It may result from attempting to suture an actively diseased bronchus or may be the result of inefficient

bronchial suture. Bronchopleural fistulae are also more likely to occur about the tenth day and are usually heralded by a rise in temperature and the expectoration of blood-stained sputum. The development of a communication between the bronchial tree and pleural cavity may lead to the expectoration of a quantity of blood-stained pleural fluid which may or may not be infected, and also to the accumulation of air in the pleural cavity resulting in a tension pneumothorax. Small bronchopleural fistulae will often close satisfactorily if a drainage tube is inserted into the pleural cavity and suction applied in order to keep the lung expanded and the pleural space small. Larger fistulae are best treated in the early stages by reopening the chest and reclosing the bronchus with the suture of a pedicle of intercostal muscle to the bronchus stump. If, however, an empyema is present, tube drainage should be performed and maintained until the acute infection has subsided when secondary suture of the bronchus stump may be carried out.

Empyema

The majority of empyemas are secondary to the development of a bronchopleural fistula, but occasionally an empyema occurs without a fistula. These should be treated along ordinary lines with repeated aspirations followed by drainage.

Spread of disease

A spread of tuberculous disease on either the operated or the contralateral lung is a relatively uncommon complication, but one which can be serious. It is usually produced by uncontrolled bronchopulmonary secretions resulting in an aspiration pneumonia or, alternatively, is the result of reactivation of pre-existing lesions: in either case there is little that can be done except to ensure that effective chemotherapeutic agents are employed. The future in such cases depends largely on the patient's ability to resist renewed infection.

Results of resection

The results of resection in pulmonary tuberculosis have been improving steadily with the increased use of chemotherapy both before and after operation (Bickford and his colleagues, 1957). At the present time, cases can be divided into two main groups In the first group are those patients where residual nodules or cysts are being removed largely as a prophylactic measure. In these cases, complications are few and the results are extremely satisfactory. The second group constitutes patients with more extensive disease, usually of many years standing, where other measures, often carried on for a long time, have failed to control the disease adequately In these cases the lesions are often widespread and the results on the whole, although satisfactory, are less good than in the former group. Late complications in either group are remarkably few.

CARCINOMA OF THE BRONCHUS

The 3-year and 5-year survival rates after pneumonectomy for carcinoma of the lung employing a standard routine resection has remained fairly constant over the past 10 years

Sellors (1955) found that of 446 resections carried out between 1940 and 1950, 30 per cent were alive at 3 years and 21 per cent at 5 years after the operation. Nicholson, Fox and Bryce (1957) recorded that 28 per cent of their patients undergoing radical resection between 1948–50 had survived 5 years. Bignall and Moon (1955) surveying 531 patients operated upon at the Hospitals for Diseases of the Chest between 1940 and 1951 showed that, after excluding those dying within 2 months of the operation, one-third of the patients survived for 5 years. These reports all suggest that the operation has now become fairly standardized throughout the country.

Delay in submission for operation

Unfortunately, those considered suitable for and submitted to operation only constitute a fraction of those suffering from the disease. Various estimates place the figure between 15 and 20 per cent This proportion has not been greatly increased by widespread attempts at earlier diagnosis including, especially, mass miniature radiography and medical propaganda Various surveys still indicate that there are many and varied sources of delay from the time of the first symptoms to that of effective treatment. Much of this delay occurs at hospital level and is partly an administrative problem but, nevertheless, one which should be capable of considerable reduction. The initial delay on the part of the patient in first consulting the private doctor is less easy to influence, but something should be possible by more intensive propaganda and refresher courses for general practitioners. However, as Bignall (1955) pointed out, even very early diagnosis does not solve the situation, as 6 per cent of patients presenting with histories of less than a month already had metastases, a figure which rose to 50 per cent for those with a history of 5 months. Notwithstanding, only 12 per cent of those with a history longer than a year had demonstrable metastases: this is presumably because of the inherently slow rate of growth of these tumours It is this factor perhaps more than anything else which appears to influence the ultimate prognosis irrespective of the nature of the treatment.

Direction of surgical endeavour

In the meantime, surgical endeavour has been directed along the following lines: (1) the development of more radical removal of the primary tumour and the draining lymphatic nodes and channels; (2) methods designed to conserve as much normal lung tissue as possible in keeping with an adequate removal of the tumour; (3) study of the mode of survival of the patients with various attempts to improve it, (4) raising the resectability rate; and (5) management of the inoperable case.

Radical pneumonectomy

Brock and Whytehead (1955) pointed out that the basis of any good cancer operation consists of the total extirpation of the affected viscus and its [illegible] investments and a block removal of the associated lymphatic field.

Applying these principles to the treatment of lung cancer they describe the operation of "radical pneumonectomy". The lung is removed by exposing the pulmonary artery and veins inside the pericardium and the bronchus is divided as close to the [illegible]

trachea as possible. A collar of pericardium surrounding the hilum is removed with the lung.

The lymph nodes and lymph channels of the mediastinum (on both sides as far as is possible) are then removed by block dissection. The study by Nohl (1956) of the lymphatic spread of lung cancer underlines the importance of removing the nodes from the opposite mediastinum, especially in the case of the left lower lobe.

The operative mortality for the radical operation is 11 per cent which compares fairly favourably with the less radical procedures The follow-up period is as yet too short to judge whether the operation gives a significantly higher survival rate.

Lobectomy

For many years surgeons have been content to remove peripheral tumours by a physiologically conservative resection (that is, by lobectomy). Survival after such procedures compares favourably with the more extensive operation of pneumonectomy for similar lesions A second group who have had a lobectomy performed are those with a limited respiratory reserve where it was necessary to conserve as much normal lung tissue as possible. It was found that, even in this less encouraging group, the survival rates were not appreciably lower than after pneumonectomy.

Belcher (1956) and his colleagues have surveyed 264 patients on whom a lobectomy was performed during the last 6 years. Approximately 50 per cent of 160 patients operated on have survived for more than 3 years. Similarly Bignall and Moon (1955) recorded figures of 44 per cent surviving for 3 years compared with 38 per cent for pneumonectomy.

These figures certainly suggest that, given the circumstances which make a lobectomy a practicable and adequate cancer operation, the results in the terms of survival are comparable with those of a more radical pneumonectomy. There is, however, a good deal more to the problem than mere survival, as of almost equal importance is the mode of survival. There seems little point in living for 5 years after a major operation if during this time one is crippled by shortness of breath and incapacitated by pain.

Personal experiences with the operations of pneumonectomy and lobectomy for cancer over the past few years lead one to the following conclusions:

(1) That pneumonectomy patients have a smoother post-operative course from the point of view of bronchial secretions but they are more liable to cardiac irregularities, especially auricular fibrillation and cardiorespiratory failure.

(2) The later course runs strongly in favour of the lobectomy. Not only is the reduction of the ventilatory reserve much less but the insidious effects of mediastinal displacement and chest wall contraction are largely absent. These effects take the form of a sense of heaviness or tightness in the chest often amounting to actual pain.

The use of prostheses after pneumonectomy

There is good evidence that some of the deleterious effects of pneumonectomy are due to the marked mediastinal displacement, chest wall contraction and fibrous tissue formation which represent the attempts of Nature to obliterate the dead space which follows lung removal.

These compensating changes not only result in over-expansion of the opposite lung—with some reduction of functional efficiency, as shown by McIlroy and

Bates (1956)—but the displacement of the mediastinum and chest wall and the formation of fibrous tissue leads to a feeling of tightness or heaviness in the chest which may become unbearable.

These changes can largely be prevented by carrying out a thoracoplasty or by introducing a plastic prosthesis on the affected side. A thoracoplasty is a rather formidable procedure whilst the presence of a plastic prosthesis in the space may lead to infection at some later date This latter risk can, to a certain extent, be reduced by inserting the prosthesis 2-3 weeks after the original operation by which time the cavity is more stable, risks of a bronchial fistula are reduced and the chances of infection are lessened *Many surgeons, however, take exception to* [illegible] the argument carries less weight

Sleeve resection of the bronchus

The satisfactory results following lobectomy have encouraged surgeons to extend its scope by combining lobectomy with the excision of a sleeve or cuff of adjacent main bronchus in those patients where the origin of the lobar bronchus is involved by growth and where a formal lobectomy is not, therefore, practicable.

The technical details of the resection of bronchial strictures with grafting or end-to-end anastomosis has been largely developed by Gebauer (1952). Price Thomas (1956) has recorded the successful application of this principle to the treatment of both benign and malignant lesions

The operation is most easily applied to upper lobe lesions but can readily be performed in lower lobe tumours Similar principles have been employed in the removal of tumours invading the carina and the lower end of the trachea The technical problems in carrying out a sleeve resection are not great and the post-operative course in the majority of cases has been remarkably smooth

The advantages of the procedure are considerable Not only is a useful functioning lobe retained in the body but mediastinal displacement is prevented Should recurrence of growth occur either in the same or the opposite lung the possibility of further surgery still remains open to the surgeon

Management of the inoperable patient

It will be recalled that only 20 per cent of patients with lung cancer are considered suitable for an exploratory thoracotomy and of these about 1 in 5 are found to be unsuitable for any form of radical surgery The usual practice in such cases is to close the chest and administer symptomatic treatment.

Recently Smith (1957) has advocated a palliative resection in such patients and has found the results of such an approach well worth while He regards survival for at least 8 months with return to work as a satisfactory result and on this basis, half of the survivors after palliative resection fall into this category. The operative mortality (20 per cent) is higher than for the curative procedures, as one would expect He also has noticed that the length of the terminal illness has been significantly reduced, probably due to the removal of breaking-down growth and septic lung tissue.

More orthodox management of the irremovable growth has been carried out by

post-operative irradiation but results have been discouraging. The effect of a 4–6 weeks' course of radiation following shortly after a major thoracic operation often proves too much for all but the most robust individuals, and one is hardly justified in keeping a patient, with a very limited expectation of life, in hospital for such a long period.

A recent encouraging development, however, consists of the injection of radioactive gold seeds into the growth and its extensions at the time of the thoracotomy. It is possible in cases where the tumour mass is not too large to inject an effective dose into the whole tumour. This can usually be carried out accurately under direct vision and there is a minimum of irradiation to nearby normal structures.

The patient is little affected by the procedure being, perhaps, rather more ill during the first few post-operative days than is usual but thereafter having a normal convalescence. The effect on the tumour is variable—sometimes dramatic and at other times disappointing. It is, as yet, too early to comment on the effects on survival rates or on the mode of survival, but results to date are encouraging

Two modifications of the gold-seed technique are being pursued, namely, the [illegible] obstruction.

These methods, it is hoped, will improve the lot of those patients who are not grossly inoperable when first seen, but, unfortunately, there still remains a vast number of patients for whom little can be done beyond the alleviation of the symptoms.

PULMONARY CYSTS

A cyst is difficult to define and equally difficult to classify and pulmonary cysts prove no exception The term is used very loosely to define a more or less rounded cavity *with a distinct lining membrane distended with air, fluid or semi-fluid* material. Many and varied classifications of bronchopulmonary cysts have been suggested from time to time but none is entirely free from criticism. The following description of several broad groups is therefore given as having probably the greatest practical importance but does not pretend to be a scientific classification.

Epithelial-lined cysts.—These are usually solitary or few in number and varying in size from 2 to 10 centimetres. They are lined with a well-developed cuboidal, squamous or respiratory epithelium and they may contain muscle or cartilage in their walls. They usually communicate freely with the bronchial tree.

[illegible] This group includes a [illegible] sence [illegible]

Emphysematous cysts (emphysematous bullae).—In this group the cavities are formed by the distension of existing air sacs and the amalgamation of adjacent sacs following distintegration of the intervening walls. In this way large and often bizarre-shaped air containing spaces are formed. The walls of these cysts are not lined by epithelium but are formed by the surrounding lung tissue.

Pseudo-cysts—This group includes cystic cavities resulting from previous

infective conditions such as a lung abscess or a tuberculous cavity where the [illegible] The cysts are lined by fibrous tissue, but [illegible] grow in from the mouths of draining [illegible] r wall. Muscle or cartilage, however, is never found in the wall.

Parasitic cysts—The commonest example of this group is the hydatid. These occur sporadically in Great Britain (particularly in Derbyshire and South Wales) but are common in the Middle East and Australia

We intend here to discuss only the epithelial and the emphysematous cysts.

Epithelial cysts

Aetiology

These cysts are considered to be developmental in origin and are often associated with other congenital abnormalities such as cervical rib and congenital heart disease. The presence of such an additional abnormality provides circumstantial evidence in favour of a diagnosis of an epithelial cyst where the diagnosis may be in doubt.

Pathology

The cysts are usually solitary or few in number and vary in size from about 2–10 centimetres in diameter. giant varieties are not seen. They are more common in the lower lobes There is normally a good communication with the bronchial tree but both the latter and the surrounding lung tissue are normal as revealed by bronchography.

The wall is lined by cuboidal, squamous or respiratory epithelium and fragments of muscle and cartilage can usually be found in the wall

Clinical features

The majority of these cysts are silent and many are undiagnosed until complications ensue. Occasionally, in children, their size may give rise to symptoms of respiratory distress but this is rare More commonly they are brought to light by infection or haemorrhage Infection produces a pneumonic illness with fever, cough, sputum and chest pain. Later symptoms closely simulate those of a lung abscess and differentiation between the two may be difficult, if not impossible, at this stage. Before the use of antibiotics patients with infected cysts were often treated as for a lung abscess or an empyema by drainage, and the true nature of the condition was only realized when the "abscess" failed to shrink and heal

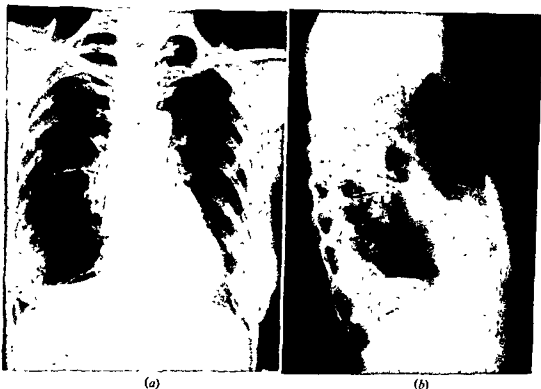
Haemorrhage is not a common complication but, occasionally, moderate repeated bleeding occurs. Sometimes the cyst fills with a clot producing characteristic radiological appearances (the so-called blood cyst with a crescentric air cap) Secondary invasion with fungi such as aspergilli also occasionally occurs.

Spontaneous pneumothorax is a rare complication contrasting with the emphysematous cysts

Radiological features

Typically a cyst is spherical though occasionally its outline is modified by contact with an interlobar fissure, a bronchus, the chest wall or the mediastinum

(Figs 8 *a*, *b*) Its edge is sharply defined and thin. The cyst itself may contain air alone, fluid alone, fluid and air, or blood clot.



Figs 8 a, b—Antero-posterior and lateral radiographs of a patient with a large infected *epithelial cyst in the right lower lobe. After control of infection a lobectomy was performed.* The cyst contains pus and air and its spherical outline is modified by the chest wall and diaphragm

Treatment

Epithelial cysts only require surgical treatment when complications have occurred. The uncomplicated cyst, found accidentally, can safely be kept under observation. The only effective treatment is excision which should be carried out in an anatomical manner by segmental resection or lobectomy There is little place for local excision owing to the risks of troublesome air leaks and subsequent infection of the pleural space.

Infected cysts should first be treated by appropriate antibiotics in an attempt to sterilize the contents, prior to excision A cyst filled with fluid presents a definite hazard of rupture into the bronchial tree during removal, so that all attempts should be made to empty it by postural drainage prior to operation. If this is unsuccessful the cyst should be aspirated when the chest has been opened and prior to manipulating the lung and the cyst.

Emphysematous cysts

An emphysematous cyst is produced by over-distension of the lung atria and alveolar sacs with breakdown of the walls between individual sacs to form larger spaces Two processes are involved, one *inflationary and the other degenerative.*

The cysts may reach gigantic proportions and compress and displace adjacent normal lung tissue and the mediastinal contents In addition to the actual compression of pulmonary tissue, the capillaries in the lung are also compressed so that the circulation through the affected lung is considerably hampered

Aetiology

The condition is imperfectly understood but there are probably a variety of aetiological factors of which the following deserve consideration·

(1) Deficiency of cartilage in the smaller bronchi so that their patency is not maintained during expiration (flutter valve)

(2) Defective formation of elastic tissue which reduces the elastic recoil during expiration so that air tends to be trapped in the lung.

(3) The effect of repeated infection (bronchitis) or involvement with dust (pneumoconiosis) of the terminal bronchioles leading to their partial or complete obstruction

(4) Gross over-expansion of normal lung (compensatory emphysema) after resection of lung, permanent lobar atelectasis or widespread destructive lesions.

(5) Degenerative conditions probably play their part with some of the above and alone may be found in the aged (senile emphysema).

In any one individual multiple factors are probably operating.

Physiological considerations

A great deal of attention is being paid by respiratory physiologists to the problem of the emphysematous patient at the moment and the full extent of the disturbed physiology is still imperfectly understood Certain changes are, however, well recognized.

(1) There is a reduction in ventilatory efficiency caused by the over-distension of the chest and permanent descent of the diaphragm.

(2) There is a considerable increase in the dead space air so that more ventilation is required to produce an adequate exchange of air between the alveoli and the inspired air.

(3) The cysts themselves are space-occupying lesions and compress a normal functioning lung so that the ventilation of these areas is more difficult.

(4) Owing to the loss of elasticity in the lung, air tends to be trapped in the abnormal areas

(5) The reduced blood flow through emphysematous areas results in imperfect oxygenation of the blood.

(6) The frequent association with bronchitis further depresses both ventilation and the interchange of gases between the blood and the alveolar air.

Clinical features

Emphysema may affect patients of any age but is most common amongst the middle aged In infants and small children they present special problems which will be considered separately Men are more commonly affected than women. The patient often suffers from bronchitis but the condition can occur quite independently The onset of symptoms is usually gradual, though it is occasionally remarkably sudden Shortness of breath is the only significant symptom caused by the

cysts themselves: occasionally tightness in the chest is noticed. Frequently the lesion is discovered during investigations of chronic or recurrent bronchitis. Attacks of bronchitis in the emphysematous patients are inevitably more severe, serious and prolonged than in the normal individual, and severe anoxic changes occur in the more seriously affected patients and are an important cause of death. Not infrequently the condition is brought to light by the development of a spontaneous pneumothorax. Dyspnoea in such cases may be extreme and anoxia marked. A fatal outcome is likely if relief is not promptly carried out.

Infection of and haemorrhage into the cysts may occur but these complications are much less common than with the epithelial cysts.

Radiological features

The radiological changes are bizarre, widespread and often bilateral. The lung is more translucent than normal and its structure is replaced by large translucent spaces with thin irregular borders (Fig 9) Sometimes one cyst dominates the scene and the compressed lung can be seen surrounding it.

Confusion may be made with a spontaneous pneumothorax, but in the latter condition the edge of the collapsed lung can be seen along the inner border of the translucent area whilst in the case of emphysematous cysts, fine trabeculae can be seen traversing the space The bronchial tree is not grossly affected but the bronchi generally are thin and may be displaced and distorted by over-distended cysts.

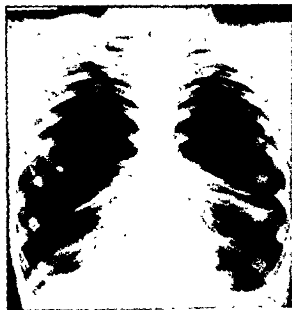


FIG. 9.—A patient with bilateral giant apical emphysematous cysts Fine trabeculae can be seen traversing the lower portion of the cyst on each side

Treatment

As the condition appears to be progressive every attempt should be made to delay its progress. Frequent coughing and attacks of bronchitis are both important aggravating factors Prohibition of violent and spasmodic coughing, cessation of

smoking and vigorous treatment of attacks of bronchitis may all help to delay progress of the disease. Severe exertion should be avoided in order to prevent a spontaneous pneumothorax, and breathing exercises may improve ventilation. Patients with particularly frequent attacks of bronchitis can be maintained on antibiotics throughout the winter.

Surgical treatment has been employed sporadically for many years without spectacular success, but of recent years a good deal of progress has been made so that, at the present time, a considerable number of severely handicapped patients can be considerably improved by surgical means.

There are a number of different methods of treatment which are applicable to these patients. The precise indications for any particular method depend on the local pathological condition—in many, combinations of the following may be used:

✓*Phrenic paralysis.*—Allison (1947) pointed out that diaphragmatic movements have a valvular action on certain basal cysts, and thereby produce distension. He recorded a case considerably relieved by temporary phrenic paralysis but with recurrence of symptoms when the diaphragm started moving again The operation must have limited application and there are dangers of depressing ventilation to dangerous levels

Lung resection.—Where the disease is limited to one segment or lobe, anatomical resection is not only practicable but the operation is of immense value. However, it is frequently noted that the pathological changes are widespread and involve all 3 lobes so that a limited resection is not possible, and a pneumonectomy is inadvisable because of a likelihood of changes being present on the opposite side.

Obliterative cystorrhaphy (plication of cysts)—This method mentioned by Graham (1949) has been practised by the author in a number of cases with very satisfactory results. The operation is quickly performed and consists essentially of placing a series of ligatures around the cysts in order to obliterate them. There is no theoretical limit to the number of cysts or to the size of those which can be treated in this way. The chief advantage of this procedure is that no lung tissue is removed and no raw lung surfaces are left

Excision of cysts—Occasionally an isolated pedicled cyst is encountered at thoracotomy where excision of the cyst and ligation of the pedicle is readily performed More frequently the cysts have a broad base buried in the substance of the lobe Naclerio and Langer (1947) advocated excision of the visceral pleura overlying the cyst and the obliteration of the space by mattress sutures. More recently Stringer and Burnett (1956) reported success with a similar procedure, pointing out that the operation conserves as much lung tissue as possible. Capel and Belcher (1957) reported its [illegible]

patients who subsequently required a thoracoplasty to close the residual space.

Intracavitary suction drainage.—This was first practised and advocated by Head and Avery (1949) As a first step adhesions between the layers of the pleura must be produced and later a fine catheter is inserted into the cyst and suction drainage applied The operation serves to decompress the cyst and to encourage the expansion of adjacent compressed lung, whilst the presence of a foreign body (namely,

the tube) in the cyst appears to set up an inflammatory reaction which leads to the eventual obliteration of the latter. The procedure is, however, rather tedious and prolonged and fresh cysts not infrequently appear when one is decompressed so that the operation has never been very popular.

Pulmonary autonomic denervation.—Abbot and his colleagues (1953) have been largely responsible for developing this procedure. Removal of both vagal and sympathetic fibres passing to the lung was originally advocated but more recently more satisfactory results from pulmonary vagotomy alone have been reported. The chief effect of the operation would appear to be the relief of bronchial spasm and the consequent reduction of the inflationary elements. The operation can well be combined with other methods of more direct attack upon the cysts

Indications for operation

These are hard to define, but generally speaking the cysts should be large, occupying one-third or more of the lung field, so that removal or obliteration is likely to have a definite mechanical effect upon the patient. By and large the larger the cyst the more seriously ill is the patient and the more urgent is the treatment.

The presence of bronchitis adds appreciably to the risks of the operation but does not constitute a contra-indication. Every attempt should be made to control the infection both before and after operation.

Emphysematous cysts in infancy

Emphysematous cysts in infants and young children are not uncommon and are particularly serious If the cysts become even slightly distended, the surrounding tissues and organs are rapidly and severely compressed, resulting in grave respiratory embarrassment and anoxia. Symptoms may be precipitated or aggravated by a respiratory infection with the child rapidly becoming severely distressed. The chest is found grossly distended, and the trachea and heart considerably displaced away from the side of the cyst

The diagnosis is confirmed by radiology. No attempt should be made to decompress the cyst by a needle or a tube unless it be in preparation for a thoracotomy. Operation is often an emergency. The child is anaesthetized without any positive pressure and the chest rapidly opened; this allows the cyst to herniate into the wound and decompresses the patient and relieves the immediate difficulties for the child. A relatively unhurried operation can proceed from this point.

Tracheostomy

Tracheostomy has been employed in various stages of the management of patients with emphysema with increasing frequency and gratifying results, and deserves special mention

It is indicated in acute exacerbation of bronchitis with severe anoxia or carbon dioxide intoxication, and in the post-operative management of some of the more seriously ill patients

Its advantages are (*a*) it reduces the dead space, (*b*) it permits frequent and relatively atraumatic aspiration of bronchial secretions; and (*c*) it permits mechanical ventilation in patients with respiratory depression

POST-OPERATIVE CHEST COMPLICATIONS

Introduction

In recent years the scope of surgery has increased and many major operations are now undertaken in old, frail and ill patients. Chest complications are common in such persons but they also occur, and can be equally damaging, in younger, fitter people undergoing less major surgery Post-operative chest complications are most often basically due to bronchial "embolism" or "thrombosis", that is, the inhalation of some foreign material into the bronchial tree or the failure to expel existing bronchial secretions The pre-operative, operative and post-operative management of bronchial secretions assumes great importance if simple and serious chest complications are to be avoided or adequately treated if they occur.

Aetiological considerations

There are invarably several factors which contribute to the development of a post-operative chest complication; there is no single cause.

Smoking

This has been shown to be one of these factors Morton (1944) found that the morbidity rate for smokers taking more than 10 cigarettes or ½ ounce of tobacco a day was 6 times that for non-smokers and he showed further that smokers were the more likely to develop serious complications.

Type of operation

The type of operation has a considerable influence for chest complications are commonest following upper abdominal operations and are also common after operations for hernia King (1933) found the incidence of chest complications in 3,037 abdominal operations (including those for hernia) was 13 per cent, while the incidence following 4,028 operations on other parts of the body was only 1 per cent. [illegible]

response to operation.

Anaesthetic agent

The type of anaesthetic agent employed does not appear to have a significant bearing on the problem but the duration of anaesthesia almost certainly has, for the incidence of chest complications is higher in operations of long duration but here, of course, greater surgical trauma is also likely to be inflicted.

Chronic bronchitis

This is an undoubted predisposing factor and requires emphasis Its exact influence is not certain because it is a condition which is loosely defined and it may be very difficult to distinguish between the true bronchitic, who has a chronic cough with mucopurulent sputum, and the patient who has a "smoker's cough". In both cases, however, sputum is present in excess before the operation is even

begun and the stage is set in these patients for continued production of sputum and sputum retention in the post-operative period which may lead to complications. Furthermore in chronic bronchitis the sputum is usually infected with *Haemophilus influenzae* or with pneumococci or with both, but the patient ordinarily manages to keep this infection under reasonable control. Post-operatively conditions may occur favouring bacterial multiplication and the chronic bronchitic is especially liable to acute exacerbations of his infection.

Upper respiratory tract infection

The presence of an upper respiratory tract infection at the time of operation is a well-recognized factor in the later development of a pulmonary infection and it is well known that it is extremely risky to operate if the former is present unless it be for an emergency.

Normal mechanisms

Negus (1933) described the various mechanisms by which the bronchial tree guards itself against infection or the entry of foreign material. Disturbance of these normal mechanisms is very likely to occur during anaesthesia and post-operatively. They may be outlined as follows:

The cough reflex

The mucous membrane of the trachea and main bronchi is extremely sensitive when first stimulated by sputum or other material coming in contact with it, but this sensitivity is very rapidly lost if the material is not coughed up. Thus is explained the familar finding of the patient whose trachea and bronchi are full of rattling secretion yet who seems oblivious to its presence and makes no coughing effort unless ordered to do so.

Mucus secretion

The bronchi are normally sterile and this sterility exists in spite of the continued inhalation of organisms. Mucus secreted by bronchial glands has a bacteriostatic effect but this effect can be easily disturbed when alterations in the quality and quantity of the mucus occurs.

Ciliary action

In health bronchial secretions are continually passed upwards by movement of cilia which arise from the cells lining the respiratory tract. The action of cilia depends on their being bathed in mucus, and for their proper action normal mucus is required. Thus, alterations in the character of the mucus such as increased viscosity or *p*H changes following bacterial growth may seriously affect the power of the ciliary escalator. This mechanism seems particularly vulnerable during and immediately after operation.

Types of pulmonary complications

Simple bronchitis

This is the commonest type of complication and appears within 24 hours of operation. It is a mild infection of the bronchial tree and is due to the multiplication

and spread of upper respiratory tract organisms throughout the bronchial tree. There is cough productive of thin mucopurulent sputum, a slight fever but no abnormal signs in the chest apart from some râles. Recovery is the rule; there is no residual damage and the post-operative course is hardly affected More serious complications can, however, follow this condition: they should be recognized early and be carefully managed.

Purulent bronchitis

This develops within the first 48 hours after operation and is a very severe infection of the whole bronchial tree. It is most often an acute exacerbation of a pre-existing chronic bronchitis and large amounts of purulent sputum are produced. Th [illegible]
of [illegible]
be [illegible]
keeps coughing; if, however, it is tenacious, atelectasis becomes probable. There is some elevation in temperature, pulse, and respiration with râles audible throughout the chest. Purulent bronchitis can resolve spontaneously or proceed to bronchopneumonia or to atelectasis.

Atelectasis

Post-operative atelectasis follows obstruction of a bronchus with mucus or mucopus and occurs within the first three days of operation. The obstruction may be multiple and peripheral—the so-called "patchy atelectasis"—or a large bronchus such as a lobar or main bronchus may be obstructed. Atelectasis is usually accompanied by considerable constitutional disturbance with marked elevation of respiration, pulse rate and temperature and perhaps cyanosis, as a sudden reduction in the patient's respiratory reserve has been produced. However, a form of silent atelectasis occurs where there may be lobar collapse with relatively little effect on the patient. The subsequent course depends on whether the obstructing plug or plugs are coughed up and whether or not a bronchopulmonary infection is also present

Bronchopneumonia

This may follow rapidly upon patchy atelectasis or purulent bronchitis and is a severe infection of lung parenchyma, usually bilateral and affecting mostly the lower lobes of the lungs It is accompanied by marked constitutional signs and can be fatal.

Lung abscess

This is a late post-operative complication but one which is initiated in the early post-operative phase as it is due to bronchial obstruction from unexpectorated mucopus, blood, vomit, or foreign body. From a stage of atelectasis of lung, commonly segmental, severe infection occurs in the collapsed portion of lung; there is a central breakdown with liquefaction and then generally a communication with the bronchial tree is re-established around the tenth to fourteenth day, and the abscess is expectorated This is a most serious post-operative complication and is accompanied by persistent and severe constitutional signs.

The pre-operative management of bronchial secretions

Lung complications can be prevented or minimized by attention to careful preparation of the patient for operation. There are certain essential considerations.

Operation at the optimal time

No detailed comment is necessary on the fundamental importance of performing an operation of election at a time when the patient has been brought into the best position to undergo it. Brock (1936) drew attention to a regrettable truth, namely, that operation is sometimes undertaken on an imperfectly prepared patient in order that the operating list should be filled and that a hospital bed should not be wasted. Such a practice is obviously dangerous and a lengthened convalescence may in any case follow. Particularly should consideration be given to the preparation of chronic bronchitics or heavy smokers, especially if they are to undergo an abdominal operation.

Upper respiratory tract infection

It is highly important that time is given for the complete disappearance of any recent coryza, pharyngitis or tonsillitis The teeth should be critically examined and treated if necessary and any paranasal sinus infection should be brought under control.

Breathing exercises

These are of the greatest value. Although they do not produce any measurable increase in pulmonary function they do teach the patient breathing control and train his muscles of respiration, including accessory muscles, to work efficiently and with the minimum of effort. The range of diaphragmatic movement is increased by breathing exercises and this is an important acquisition particularly in patients who are to have a chest operation as, for a few days afterwards, intercostal respiratory movement is very much reduced on the operated side and the diaphragm assumes great importance in maintaining adequate ventilation.

Most vital of all, however, is the training the patient is given in coughing: if he can be taught to understand the mechanism of the cough (which is to inspire fully, make a strong expiratory effort against a closed glottis, then suddenly open the glottis and continue expiration to the full so that sputum in the trachea is expelled and sputum lower down is squeezed upwards by forcible bronchial contraction) and taught how to raise his sputum with economy of effort, he will have more confidence in his ability to do so after operation and will understand its fundamental importance.

The chronic bronchitic

These patients present special and often individual problems. They have a cough with sputum, the volume and character of the sputum varying, sometimes being purulent, sometimes mucoid. Generally, purulent sputum is expectorated with ease, mucoid with difficulty. Practically all chronic bronchitics with purulent sputum have *Haemophilus influenzae* or pneumococci as the predominant pathogens

in the sputum which are usually sensitive to penicillin; but if not they can almost always be eradicated by a broad spectrum antibiotic such as tetracycline. Bronchitic patients with purulent sputum who are being prepared for surgery should have their bronchial infection controlled beforehand in order to reduce the chances of a post-operative exacerbation. It is advisable to start the antibiotics 5 or 7 days before operation for it is found that the sputum will gradually become less purulent and finally mucoid; this change, which takes 3 or 4 days, is accompanied by an increase in the viscosity of the sputum which becomes more difficult to expectorate. It is best if this alteration in viscosity occurs before operation so that the patient can become adjusted to the increased coughing effort necessary. If the sputum becomes sticky shortly after operation and at a time when coughing is difficult and painful, the stage will be set for bronchial "thrombosis" and its sequelae. The bronchitic is also helped in the pre-operative period by being given bronchial antispasmodics, such as aminophylline orally (0·1 gramme, 6 hourly) or an isoprenaline spray (1 per cent solution).

At operation

The position of the patient on the operating table is not of great importance except where the operation is long Then it must be recognized that any parts of the lungs which are dependent and fixed will aerate poorly. This is particularly true when the patient is for a long time in the lateral position, and there is reduced movement and air entry in the lowermost lung whether the patient is breathing spontaneously or whether his respiration is controlled by positive pressure inflation Movement of secretions in this part of the lung is hindered and later patchy atelectasis may occur Where such a position has been inevitably prolonged, the immediate post-operative adoption of a corrective posture and special breathing exercises will help to improve air entry and movement of secretions in this region.

An endotracheal tube is recommended whenever excess secretions are present so that they may be aspirated during and immediately after the completion of the operation (Beard, 1948) Care should be taken, however, that extraneous infection is not introduced into the bronchial tree by careless handling of tubes or suction catheters Pharyngeal and nasal toilet is also of importance, the patient should leave the theatre with a clean upper respiratory tract. In thoracic surgery particular care has to be taken in the management of excessive secretions at operation so that pre-operative and post-operative bronchoscopic removal of them may be indicated as, for example, in bronchiectasis.

Post-operative

Relief of pain

Any surgical incision is painful, abdominal incisions being particularly so during any movement of the body and whilst coughing This acute pain on movement lasts from 48 to 72 hours and it is in this very period that movement and coughing are most required: pain must be relieved otherwise bronchial secretions will accumulate Analgesics may be required more often than the time honoured 4-hourly period between injections, and this fact should be recognized as it is imperative that pain is not only relieved but is never allowed to become severe. In most cases

pethidine (Demerol) proves to be an excellent post-operative analgesic which has practically no depressant effect on respiration and causes very little nausea and vomiting. If pethidine is ineffective then a stronger analgesic such as morphine must be given. The effect of morphine as a respiratory depressant has probably been overstressed.

Position in bed

The patient should not be discouraged from adopting a position in bed in which he is comfortable, for it will be one where he will breathe most easily and therefore most deeply. Regular changes in position, however, must be carried out so that there may be periodic full ventilation of all parts of the lungs Breathing exercises should be continued and coughing encouraged. There is now general agreement that early ambulation can be recommended, not especially to avoid post-operative complications from retention of bronchial secretions but to reduce the likelihood of venous thrombosis and pulmonary embolism.

Assisted removal of bronchial secretions

The post-operative management of a patient with an established pulmonary complication is now considered with particular reference to assisting removal of excessive bronchial secretions and the treatment of atelectasis.

Postural assistance

This is most valuable in the treatment of atelectasis, being carried out as soon as the condition is diagnosed and following a small dose of an analgesic which may be given intravenously. All pillows are removed, the patient is turned on his side with the collapsed lung uppermost, the wound is supported by the pressure of a hand and then active coughing is encouraged. Expectoration of the obstructing tenacious mucous plug will occur in many instances with rapid improvement in the air entry in the lobe involved and in the patient's condition.

Catheter suction

This is indicated in patients with purulent bronchitis or bronchopneumonia who are failing to cough up the large quantities of sputum which are accumulating Under local anaesthesia of the throat a catheter may be introduced through the nose or mouth and passed blindly into the trachea; it is then moved up and down whilst suction is applied to it. Sometimes it is difficult to pass the catheter blindly and in this event a Magill endotracheal tube is introduced under vision and the catheter can then be passed through this. Catheter suction may be repeated many times but there is the disadvantage that frequent anaesthetization of the throat is necessary and this may produce feeding difficulties.

Bronchoscopy

Bronchoscopy permits the aspiration of retained bronchial secretions under direct vision and ensures that removal of obstructing plugs in the main, lobar and segmental bronchi is complete. It is particularly indicated in atelectasis where there has been failure to cough up a mucous plug with postural assistance. The

decision to bronchoscope the patient should not be long delayed as it is essential to remove the obstruction before secondary changes, particularly from infection, occur in the collapsed lung. The procedure, which is carried out under local anaesthesia of the throat, can be performed in the theatre but can also be readily carried out in the patient's own bed.

Frequently repeated bronchoscopies are inadvisable, especially in children, owing to the traumatic effects on the larynx and trachea which in turn may lead to further secretion formation.

Tracheostomy

Tracheostomy is a most valuable adjunct in the management of a post-operative pulmonary infection and its possible advantages should be considered at an early stage, for if it is left too late it is unlikely to affect the issue in the near moribund patient with gross ventilatory insufficiency; nevertheless, even in such a patient it may be life saving.

Indications

Tracheostomy is indicated in acute purulent bronchitis and bronchopneumonia where secretions are excessive and repeated tracheal aspiration is essential. it is superior to the alternative of repeated bronchoscopic or catheter suction. It is especially indicated in the patient who shows signs of inadequate alveolar ventilation and who has respiratory acidosis from carbon dioxide retention. Such a patient is restless, dyspnoeic and cyanosed and with a weak and rapid pulse.

Advantages

The most important advantages of tracheostomy are that (1) it will cut down the dead air space of the upper air passages by approximately 50 per cent (Pitman and Wilson, 1955) thus creating a more effective tidal volume, (2) it provides a simple route for the aspiration of bronchial secretions, which can be repeated as often as is necessary; and (3) artificial ventilation can be readily applied with the aid of a suitable cuffed tracheotomy tube. Artificial ventilation may be required in the treatment of respiratory acidosis (Johansen, Gormsen and Dryberg, 1957).

Disadvantages

Tracheostomy has its disadvantages (1) when another operation has to be performed on an ill patient which carries its own attendant complications. These are haemorrhage, pneumothorax and mediastinal emphysema (Davis, Kretchmer and Bryce-Smith, 1953); and (2) drying and increased viscosity of bronchial secretions will occur as the inspired air is now no longer humified in the normal way by the upper air passages.

Method

Tracheostomy is best carried out as a deliberate, unhurried procedure under local anaesthesia, in the theatre or the patient's own bed Suction must be available and it may be advantageous, in the cyanosed, distressed patient, if the throat is anaesthetized and a Magill tube placed in the trachea, so that suction can be applied and oxygen administered during the operation.

Management

Aspiration of secretions.—This is performed as often as is required using a soft rubber catheter, which has been sterilized and moistened: it must be stressed that particular care is taken to ensure that further infection is not introduced into the bronchial tree. Regular cleansing of the inner tube is required. It is important that a catheter is used which does not completely block the tracheotomy tube whilst being used for suction, furthermore the suction itself should not be too forceful and prolonged as there is a possible danger of provoking acute pulmonary oedema (Brattström, 1954).

Humidification of the inspired air.—This is important and careful watch must be kept on increased viscosity of secretions and their possible incrustation on the wall of the trachea. Spalding (1956) has designed a humidifier for patients breathing spontaneously, and such an apparatus should be used if the tracheostomy has to be maintained for a considerable period.

Oxygen administration.—The administration of oxygen can be carried out by a small catheter placed just within the lumen of the tracheostomy tube and delivered at between 2 and 4 litres per minute. Alternatively, an oxygen tent may be used but if repeated tracheal aspiration is necessary the tent becomes impracticable.

Respiratory acidosis.—This can be confirmed by estimation of the oxygen saturation, pCO_2 and pH of arterial blood and when it is severe the patient must be treated by artificial ventilation. The administration of oxygen alone is insufficient and may even cause further depression of respiration. A cuffed tube must be used and a mechanical pump employed to deliver oxygen by intermittent positive pressure (Russell et al., 1956).

The tracheostomy is maintained for as long as it is required; it is not removed until the patient has overcome the pulmonary infection, the volume of sputum has become considerably reduced and vigorous spontaneous coughing is possible. Tracheostomy has been found valuable in the management of severe chest injuries and in the unconscious patient following a head injury (Andrew, 1956). Its wider use in many acute respiratory illnesses, such as a pneumonic episode in a sufferer from chronic bronchitis and emphysema, seems likely, and there would appear to be a possible application as a procedure to be carried out at the conclusion of an operation where difficulties with bronchial secretions and with ventilation seem probable.

ABSTRACTS RELATING TO PULMONARY SURGERY

Pulmonary function

Assessment before and after segmental resection

Comparison with pneumothorax.—FLEMING (1957) discusses the functioning of the lungs [illegible] treatment. In [illegible] its [illegible] tus. [illegible] ods, [illegible] able [illegible]

respiratory crippling But when antituberculous drugs were used at the same time as a pneumothorax then a more favourable result was obtained. The author here assesses

maintained on average for 3 years constituted the control group. On the side of the pneumothorax the oxygen uptake was about 10 per cent below average normal value; the minute ventilation was about 7 per cent and the vital capacity about 8 per cent below normal, but nearly two-thirds of these patients had contralateral disease which led to some error. After segmental resection it was found that the reduction of function on the resected side was only half or less than that found with the pneumothoraces. The calculations needed to arrive at many of the figures given were complex but the investigations provided evidence that pneumothorax was not, in many respects, the ideal treatment for

usually improves It is admitted that in this study there is a rather wide scatter of the results but it appears to be inevitable in work of this kind.

Recurrent spontaneous pneumothorax

Parietal pleurectomy

The treatment of recurrent spontaneous pneumothorax by parietal pleurectomy is discussed by GAENSLER (1956) He notes that in young men the condition accounts for one in a thousand hospital admissions so that it is common in military establishments. Return to duty is often prevented, a loss particularly serious in highly trained airmen.

by trapped pleural cortex. Attempts to obliterate the remaining space by using chemical

subpleural blebs for
He felt that elimina
space and therefore,
and was often able
pleura in some patie ... less import. In removing the parietal pleura, the fat below and the neurovascular bundles must be avoided A dry field is usually obtained. Patients were often up after a day and quickly discharged Complications are rare and tests of breathing efficiency are satisfactory.

Bronchiectasis

Pulmonary resection

Rationale.—GEELEN and his colleagues (1956) discuss resection in ...
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foreign bodies, in whom the symptoms are slight. In some patients, therefore, resection of the dilated bronchi, while relieving the chronic inflammation of the respiratory tract, eliminates the stresses which hitherto had suppressed the asthmatic symptoms. A typical case is described. A man aged 38 years had a 15 years' history of coughing and expectoration of purulent sputum, followed by pneumonia and pleuritis. Seven years later the left lower lobe was removed. Expectoration of sputum ceased, but breathlessness on exertion and paroxysmal dyspnoea developed. Although this is not a common phenomenon, surgically treated cases clearly show the remnants of the basic asthma. Pulmonary function tests are made before operation. In 28 patients who underwent lobectomy, the postoperative vital capacity was compatible with the loss after resection. The average maximum breathing capacity was 19·4 compared with the normal 22. The expiratory rate under normal in 18 patients was reversed after adrenaline injection. This expiratory impediment was exceptional in tuberculous patients. In 11 cases, the residual volume was disturbed, a significant difference from the corresponding tuberculous group. After pneumonectomy, the differences between tuberculosis and bronchiectasis in regard to respiratory volume and functional respiratory capacity, were marked. In bronchiectasis, the positive reaction to adrenaline is high, but despite this, adrenaline-positive cases have the worst functions, the allergic constitution in these patients probably being the chief factor in the pathogenesis of bronchiectasis. The less satisfactory functions, although not due to operation, should be considered when surgery is indicated, the ideal cases being those where bronchiectasis is caused by a tuberculous node or a foreign body. Failure to differentiate between the two groups of cases is responsible for the "paradox of bronchiectasis", as elucidated by Overholt in 1952.

Decortication of the lung

Indications and results

RUDSTRÖM and THORÉN (1956) describe decortication of the lung. After any effusion of serofibrinous fluid, pus or blood, a precipitation of fibrin on the pleurae and diaphragm occurs. This organizes angioblasts and fibroblasts invading the loose matter from the pleural surface. The peel eventually formed consists of a layer of fairly vascular and loosely organized tissue next to the pleura, a second layer of connective tissue containing few vessels and cells, the main portion, and an inner layer of necrotic tissue with fibrinoid masses with or without organisms. As the peel ages the amount of fibrotic tissue increases and the loose layers become thinner. Finally calcification may occur. If these changes occur in youth much impairment of the chest movement and a gross deformity may develop. In the chronic cases infection, not present at first, may later arise. The authors find that to treat such cases by thoracoplasty makes things worse and in recent years decortication, aided by the antibiotics, has gained in favour. The essential aim is to remove a focus of infection and to correct the mechanical handicap. At operation the patient is intubated and a wide thoracotomy performed, usually with the removal of parts of two adjacent ribs. As much as possible of the parietal pleura is cleared and then the inner peel is removed, possibly by opening through a collection of pus. Sometimes it is possible to remove the whole peel entire and rarely is any difficulty found in clearing the lung. The authors treated 4 cases of subacute empyema, 2 of haemothorax, and 13 with tuberculosis and pneumofibrothorax with immobile lung. In all cases the pleural cavity was obliterated and the focus of infection successfully eliminated. The amount of relief to the lung depends on the size and duration of the effusion and the degree of fibrotic lung changes which have resulted. By spirometric tests ventilation does not always show much improvement but the maximum breathing capacity improves. In the authors' series one patient died of cardiac failure soon after the intervention but the others did well.

Conservative resection of bronchial tree

Review of methods

PRICE THOMAS (1956) reviews the method of conservative resection of the bronchial tree. In a brief historical summary he notes that the operation as first practised was often

being unaffected, a conservative procedure was clearly needed. Segmental lung resection is now an accepted procedure and its performance is not difficult as each segment is a unit with its own artery and bronchus In tuberculous cases there is often a marked

condition. Conservative resection received a stimulus when a patient appeared with an adenoma of the left upper lobe bronchus, presenting in and nearly closing the left main bronchus But when pneumonectomy was carried out it was clear that an essentially healthy lung with slight bronchiectasis had been removed for a benign tumour. Conservative resection of the bronchial wall for simple tumours has now been much developed and even carcinoma has been thus treated, even when the carina is involved. Sometimes a tuberculous bronchostenosis is encountered and proves amenable to partial resection, but at times the extensive spread of the disease is not realized or the organism is unusually

the left side it is less necessary to transect at tracheal level. In general as much normal lung tissue as possible should be saved, while removing all which is clearly diseased. The writer feels that the procedure of segmental resection should raise no objection where the disease is confined to one segment and recurrence is unlikely.

Pulmonary tuberculosis

Timed vital capacity and maximal breathing capacity

Pre-operative and post-operative estimations.—LITTLE (1956) reports on estimations of timed vital capacity and maximal breathing capacity in 272 cases of pulmonary tuberculosis before and after surgical treatment The second test was usually performed 3 months after the operation, thereby ensuring that the measurements were not modified by post-operative pain. Estimations of timed vital capacity were found to be more satisfactory for clinical work. Recordings were made during the first second of forced expiration into a Benedict spirometer. Thoracoplasty produced a greater loss of vital capacity than segmental resection. The mean loss was found to have increased with the number of ribs removed. When lobectomy was combined with thoracoplasty the mean loss was greater than with lobectomy alone. Comparable variations were observed when segmental resection was performed in place of lobectomy. Occasionally a large loss of capacity was detected when haemothorax occurred after resection. No correlation was established between loss of ventilatory function and the age of the patient, the duration or type of disease and the post-operative complications. The author concludes that, with special reference to the effect upon vital capacity, induction of pneumoperitoneum was the least crippling of the operations which were performed on the series of patients. It is

Carcinoma of the bronchus

Mode of spread

The method of spread of carcinoma of the bronchus is discussed by NOHL (1956) He remarks that our knowledge of the anatomy of the lungs needs revision in the light

of recent knowledge of the way in which cancer spreads. In this investigation 100 lungs resected for cancer were examined; 71 from pneumonectomies and 29 from lobectomies. While still fresh and unfixed each specimen was cleared of visible lymph nodes and their relationship to the nearest bronchus was noted. Vascular involvement was also considered and pieces of pulmonary vein were examined while any possible spread to visceral or parietal pleura was also noted. The growths involved were of four types, squamous cell, undifferentiated, adenocarcinomatous with squamous cell or undifferentiated cells, and finally oat-cell cancer. Nearly 90 per cent of the specimens had lymph nodes involved in the pneumonectomy cases but only about 40 per cent in the lobectomies. These percentages are higher than the usual figures. Without microscopy it was often difficult to tell if the lymph nodes were involved by growth, and it was found that microscopic metastases usually occurred under the capsule of the node where the afferent lymph vessels enter the peripheral sinuses. There is little recent work on the lymphatic spread of lung cancers and the author gives a table showing the manner in which the various growths spread. He found that lower lobe growths metastasize upwards, sometimes even into the lymph nodes round the segmental bronchi of the upper lobe. The subcarinal and paraoesophageal nodes are often involved, though uncommonly, with upper lobe tumours. From the surgeon's standpoint the most important nodes are those close to the lower part of the right main bronchus. The lymph nodes in this region are often infiltrated by growths from both upper and lower lobes, this has a bearing on treatment and a carcinoma of the lower lobe, even if small and peripheral, should be treated at least by middle and lower lobectomy. Growths in upper lobes do not involve nodes below a line drawn from the middle lobe bronchus to the apical lower lobe bronchus There are a few exceptions to this. The lower lobes have a slightly higher invasion rate than the upper. In some cases marked peribronchial spread had occurred with normal bronchoscopic findings; in others the opposite condition of marked spread in the submucous lymph channels of the bronchi was present In some cases, when breaking through the mucosa, fairly sudden obstruction to an air passage occurs but as the lymphatic involvement is always more extensive than anything seen by bronchoscopy any found on the medial wall of the two main bronchi within 1 or 2 centimetres of the carina is inoperable. Vascular spread was found to be rare The author puts forward a modification of the classification of lung growths hitherto in use and makes a comparison of the behaviour of the central and peripheral tumours and of the locations of the various types of these.

The case for lobectomy

BELCHER (1956) discusses lobectomy for bronchial carcinoma Since 1933, the standard operation for this condition has been pneumonectomy, this carries an operative mortality of at least 10 per cent and may make the patient a respiratory cripple Lobectomy, although generally considered inadequate, has been widely practised and reported successful. However, in 1955, Sellors and other workers recommended careful selection of patients and limitation of the operation to those with small peripheral tumours, to the elderly or to those with a low respiratory reserve. This report is based on the work of several surgeons, including the author, on 246 patients Of these, 12 died at, or soon after, operation; of the remainder, 145 have survived for a year or more. Three types of tumour were recognize squamous carcinoma 66 per cent, adenocarcinoma 18 per cent, and undifferentiate carcinoma 16 per cent. Patients with adenocarcinoma have the best survival rate (69 pe cent at 2 years), those with undifferentiated tumours appear to have a good prognosis, provided lobectomy is feasible, the 2-year survival rate being 43 per cent. For squamous-cell carcinoma it is 46 per cent. The dominant influence of mediastinal-node involvement has been emphasized. In this series the incidence was 27 per cent, while the 2-year survival rate was considerably lower than in cases without metastases. The tumours were evenly distributed throughout the lungs; there was no prognostic difference on the two sides, nor between the upper and lower lobes. Patients undergoing lobectomy for palliation did not do as well as those in whom it was performed as a policy. In assessing the value of lobectomy, it is essential to ascertain the proportion of cases in which local recurrence develops, since with this more limited operation, late metastases may be more likely. In this series 23 per cent of those dying died of local metastases The results of lobectomy,

including operative mortality, were considerably better than those reported for pneumonectomy It is arguable that patients were selected when the tumour was early and before lymph nodes were involved, but node metastases were only found in 27 per cent of the cases, compared with 58 per cent in the 1955 series of Bignall and Moon. These
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Results of radiotherapy

SMART and HILTON (1956) review the results of radiotherapy of cancer of the lung The survival rates following surgery are still disappointing, the results in inoperable cases

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surgical results Three other factors are also significant there is no operative mortality after radiotherapy, clinical evidence of cerebral metastases seems to be less common than after surgery, cases thought to be operable have been found, at surgery, to be inoperable.

Chest wall defects

Prosthetic repair

The repair of defects in the chest wall with prostheses is discussed by SOUTHWICK, ECONOMOU and OTTEN (1956). As the parts, though solid, are always moving, any material used must be pliable yet firm Sometimes part of the pectoral or latissimus muscles have been used to fill a gap but this may not always be possible and tantalum plates have occasionally been employed. Unfortunately they often cause sinus formation or become loose and require removal In operations for breast cancer the need to remove the internal mammary lymph nodes has necessitated extensive resection thus forming considerable defects Fascia lata or parts of the rectus sheath have sometimes been employed by the authors but their use may make a second surgical team necessary. Some authors having used polyvinyl sponge, which is treated with formalin, and finding that its mesh structure permitted penetration by fibroblasts, observed that it was thus possible to unite it firmly with adjacent tissues. To elucidate this mechanism more fully experiments were carried

Chest injury

Rupture of bronchus

Diagnosis and treatment.—KRAUSS (1956) points out that when a young patient sustains a severe chest injury, with tension pneumothorax but without any evidence of fracture of the bony thorax, the presence of a ruptured bronchus should be suspected if the pneumothorax quickly recurs after air has been aspirated. The diagnosis of ruptured bronchus may be confirmed by bronchoscopy and bronchography. Treatment is by primary suture. In cases of spontaneous healing stenosis may take place and in these circumstances the stenotic portion should be resected provided there is no infection of the bronchial tree. Resection of the stricture is contra-indicated if fibrosis has occurred or if oxygen diffusion is impaired. Lobectomy may be required in the management of sup-

pleural cavity was continuous it was evident that a communication existed between the bronchus and the cavity. The child died before further treatment could be carried out and necropsy revealed rupture of the right main bronchus and right apical bronchus. In another case, bronchial stenosis gradually developed in a male, aged 18 years, who had

ion was performed and the

collapsed lung was inflated

n opening in the trachea. Bronchoscopy showed a contracted scar, which was subsequently dilated by bougies.

REFERENCES

Abbott, O. A., Hopkins, W. A., Van Fleit, W. E., and Robinson, J. S (1953). *Thorax*, 8, 116.
Allison, P. R. (1947). *Thorax*, 2, 169.
Andrew, J. (1956) *Brit med J.*, 2, 328.
24, 546.
R., Gifford, J. H., Thomas, O. F., and Wad-
152.
10. 183.
Amer. med Ass, 153, 1156.
Acta med. scand., 155, 171.
h med. Bull., 4, 47
37, 404.

REFERENCES

Morton, H. J. V. (1944). *Lancet*, **1**, 368.

Naclerio, E. and Langer, L. (1947). [illegible] 22, 516.

[illegible]

Southwick, H W., Economou, S. G., and Otten, J. W. (1956). *Arch Surg. Chicago*, **72**, 901.

Spalding, J M. K. (1956) *Lancet*, **2**, 1140.

Stewart, S M [illegible]

Stringer, C [illegible]

Thomas, C [illegible]

Todd, G , [illegible]

PROGRESS IN VASCULAR SURGERY

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DIAGNOSIS OF VASCULAR DISEASE

Considerable interest has been shown in the aetiology and pathology of popliteal artery thrombosis. The majority are, without doubt, due to atherosclerosis (Mavor, 1956). There remains, however, a group of young adults, particularly males, in whom an isolated popliteal thrombosis seems unassociated with degenerative arterial disease. Kinmonth (1948), after a careful follow-up, believed that many of these were due to thrombo-angiitis obliterans. Mavor (1957) reported 4 cases of popliteal thrombosis which he suggested were due to the trauma resulting from hyperextension of the knee joint, and certainly in some young patients a popliteal artery thrombosis remains as an isolated lesion without further vascular disease even 20 or 30 years later. Another interesting pathological lesion was described by Hiertonn, Lindberg and Rob (1957) in 4 male patients suffering from popliteal artery thrombosis. In each case the exposed and excised popliteal artery was found to contain a jelly-filled cyst lying under tension within the adventitia and obliterating the vessel lumen by pressure. This cystic degeneration lay in the adventitia and should be differentiated from Erdheim's cystic degeneration of the media, as in Marfan's syndrome, which Bahnson and Nelson (1956) discussed as the cause of localized aortic aneurysms in 5 of their male patients.

The misdiagnosis of ischaemic phenomena in the lower leg is not uncommon. Bonney (1956) reported 9 patients in whom an aortic or iliac artery thrombosis presented with buttock or thigh exercise pain. All were treated previously for osteoarthritis or prolapsed intervertebral disc. The common source of mistaken diagnosis is the failure to recognize that thrombosis of the intra-abdominal vessels is not necessarily accompanied by absent femoral, popliteal or ankle pulses, although these will generally become much weaker or impalpable if the patient is

walked to the point of pain. As Bonney (1956) pointed out, such mistakes in diagnosis may not only delay appropriate treatment, as by arterial replacement or lumbar sympathectomy, but actually cause a marked deterioration in the condition of the limb through the wrong application of over-energetic physiotherapy or orthopaedic procedures.

Closed traumatic lesions of the axillary and brachial arteries due to the prolonged use of an axillary crutch are described by Rob and Standeven (1956) (Fig. 10). The rate of development, the site and extent of the block are factors which affect the prognosis; the outcome is, in general, better than in analogous lesions of the femoral artery, and gangrene is less likely to supervene. Exercise pain may, however, be a limiting factor in manual workers and in selected cases an attempt can be made to augment peripheral blood flow by excision of the thrombosed segment and the insertion of a graft Schein, Haimovici and Young (1956), for



Fig 10—Brachial artery aneurysm and thrombosis following use of an axillary crutch for 40 years



Fig 11—The dangers of a misplaced needle during aortography In this patient the right renal artery was flooded with contrast medium This was followed by a transient albuminuria

example, described a patient in whom a thrombosed subclavian artery, due to the trauma of a cervical rib, was excised and a graft introduced. Jepson (1957) discussed the diagnosis of non-traumatic arterial lesions of the upper limb. Spontaneous subclavian, axillary and brachial occlusions which are more common in women are due to degenerative vascular disease and do not usually result in finger necrosis. The forearm arteries are, in contrast, most commonly involved by thrombo-angiitis obliterans and with this disease digital necrosis is common. Spontaneous and widespread occlusion of the digital arteries may occur as a manifestation of many systemic diseases or be of unknown aetiology. Many of the latter group have an excellent prognosis and do not suffer further arterial lesions (Jepson, 1956).

ARTERIAL TRAUMA

Needle puncture

Common types of surgical trauma are those of needle puncture and arterial clamping. When a needle is introduced into an artery the track of the inner puncture wound becomes plugged by fibrin and, later, infiltrated from the lumen of the artery by endothelial cells in modified spindle-cell and macrophage forms. At the adventitial surface a more classical sequence of repair with fibroblasts and capillary loops is followed. This orderly reparation is surprisingly efficient, especially as the endothelial cells are avascular and derive their oxygen and nutrition by diffusion (Crawford, 1956).

When complications occur after arterial puncture it is most often due to the combination of large-bore needles, diseased arteries and the pressure injection of irritating contrast media. Although aortography has proved, since its introduction by dos Santos in 1929, a valuable and relatively safe technique, many complications are described. Atheromatous plaques or mural thrombi may be loosened; the point of the needle may lie within a branch of the aorta so that a small vessel is distended with undiluted contrast media, causing thrombosis of the renal, coeliac or mesenteric arteries with subsequent organ infarction and thrombosis of the lumbar arteries leading to spinal-cord damage (Fig 11).

[illegible] lumbar [illegible] ganic [illegible] ne of injection a dissecting aneurysm may be initiated. Gaylis and Laws [illegible] suggested that this is not an uncommon occurrence and may explain some of the previously reported fatal consequences of this procedure. Intra-mural injection may be recognized radiologically by the distribution of contrast media in the aortic wall: many of their own patients recovered without serious sequelae.

Experience and care will help to eliminate many of the described complications, although Lindgren (1953) demonstrated that even if a trial injection of contrast medium confirms the intra-luminal position of the needle, aortic pulsation or body and respiratory movement may cause a vital shift into the intra-mural site. There is no doubt that although arteries have a great capacity to stand occasional or repeated punctures the high-pressure injection of irritant or bland solutions can lead to a variety of complications. It is of interest, therefore, that Crawford and his colleagues (1957) have reviewed their experience with 300 aortograms for

aortic, thrombotic and aneurysmal disease. They conclude from a study of 280 aneurysms of the abdominal aorta that only 12 involved the segment of aorta from which the major visceral arteries arise. Because of this they now prefer to expose and assess the aneurysm by direct examination for, as they point out, involvement of the renal and other visceral arteries in the aneurysm no longer constitutes a contra-indication to resection and grafting In a further 215 cases of thrombotic aortic disease, patent arterial segments could always be found suitable for anastomosis distal to the major vessel block. Crawford and his colleagues (1957) now restrict aortography to the occasional patient in whom the diagnosis of aortic disease is in doubt, such as an obese person with a suspected aneurysm or partial aortic occlusion with palpable femoral pulses.

Arterial clamping

Henson and Rob (1956) pointed out that the recent progress in vascular surgery has resulted in the more frequent use of arterial clamping They have investigated 9 alternative methods of arterial occlusion in order to study the effects on the vessel wall. They consider that considerable leverage can be exerted, and consequently a harmful degree of mural and intimal damage result from the long-handled clamps such as those described by Crafoord, Brock and Potts. Screw clamps, such as the Blalock, are difficult to adjust to the correct pitch of compression The tape tourniquet, Crile and bull-dog clamps produce the least damage —they recommend tape for the major vessels and the light clamps for small arteries or collaterals.

ARTERIAL GRAFTING

Materials required

Homografts

The method of selection, sterilization and preservation of homografts has been admirably summarized by Rob and Eastcott (1953) and Rob, Eastcott and Owen (1956)

Sterilizing techniques.—It is often difficult to be confident of the sterility of donor arteries, and several authors have devised and reported on sterilizing techniques. One per cent β-propriolactone was used by Rains and his colleagues (1956), ethylene oxide by Taber and his colleagues (1956), Moore, Riberi and Kajikuri (1956), and cathode irradiation by Sewell and his colleagues (1956): of these β-propriolactone seems most satisfactory and Rains and his colleagues believe it is possible by use of this chemical to ignore the question of sterility of the graft at the time of its collection. The use of ionizing radiation as a sterilizing agent is also being explored (Buchanan and Marrangoni, 1955)

Methods of preservation.—Preservation of homografts by freeze-drying has become a generally accepted technique in most vascular surgery centres, and the results of large vessel grafting continue to be satisfactory. It has been observed, however, that canine and rabbit aortic homografts [illegible]

observations, for 3 out of 4 aortic homografts in man examined 12–30 months

after implantation showed characteristic atheromatous lesions (Creech and his colleagues, 1956).

Synthetic prostheses

The demand for arterial replacement has, in many centres, exceeded the supply of homografts, and a considerable effort has been made to find a satisfactory synthetic arterial substitute.

The synthetic grafts have many obvious advantages; they are available in any size or shape, economical, readily sterilized, and do not require the maintenance of deep-freeze or freeze-drying apparatus. Synthetic grafts are not always as easy to use as homografts and they have the disadvantages of all foreign bodies if infection supervenes Many materials have been used including Vinyon-N, Orlon, Terylene, polyvinyl-alcohol, Nylon and Teflon. The intimate composition of any one material, its chemical treatment, weave, size of fibre and final preparation are additional variables, especially as many of these prostheses are manufactured locally and are not commercially or physically standardized. These important details in preparation are frequently not stated in reported work and the evaluation of synthetics is thereby greatly hindered

As any one person's experience must necessarily be limited, the report of the Committee for the Study of Vascular Prostheses, of the American Society for Vascular Surgery (Linton and his colleagues, 1957) is of particular interest. In those vascular centres using varying types of synthetic materials 256 aortic grafts had been used· in only 17 cases could failure be directly attributed to the prosthesis. It is agreed that impermeable tubes are less satisfactory than a mesh weave, or a porous synthetic which allows fibrin to be deposited in its pores (optimal size 50–100 microns). Within a week the woven graft has, in most cases, a layer of granulation tissue surrounding the tube and continuous with the adventitia. The inner and outer coats are afterwards covered with hyalinizing connective tissue and within 4 months of implantation the cells on the inner surface are flattened to resemble true endothelium. Creech, Jordan and DeBakey (1957) found in dogs that aortic substitutes (Nylon and Orlon), unlike homografts, do not develop atherosclerotic lesions following chronic hypercholesterolaemia, although the adjacent aorta may be involved.

The occasional grafting failures in aortic surgery—according to the report of the American Society for Vascular Surgery—were disruption, thrombosis, haemorrhage and infection, and all these occurred in the late follow-up period. This experience with aortic and other major vessel synthetic substitutes compares very favourably with those of homografting The acceptance by the host tissues was satisfactory and no evidence of carcinogenesis was obtained. The most satisfactory materials appeared to be Terylene (Julian and his colleagues, 1957) and Teflon. Vinyon-N cannot be autoclaved and is not made commercially as a yarn. Nylon retains only about 25 per cent of its original tensile strength after 7–18 months implantation and, in addition, the composition of Nylon is extremely variable. There were more failures with polyvinyl-alcohol than with any other material, and no method is yet available of forming a standard prosthesis with this attractive synthetic.

Although this evidence is encouraging, the substitution of an aortic segment is

not as stringent a test as grafting in the femoral artery downwards Linton (reported by Rob, Eastcott and Owen, 1956), using homografts, reported the immediate thrombosis rate with the by-pass operation in the femoral and popliteal arteries as 1 in 68 patients, but no other series can rival this In the report of the American Society for Vascular Surgery, synthetic grafts in peripheral vessels were followed by a 37 per cent failure rate. There are many factors which may contribute to this high incidence of thrombosis· the anastomosed host vessels are of small bore and often grossly diseased; the graft may cross a flexor crease; a thin smooth-walled tube may kink; the graft material—and this is particularly true of polyvinyl-alcohol—may itself encourage thrombosis Edwards and Tapp (1956) introduced a silicone-treated crimped Nylon tube to overcome some of these objections. The prosthesis will bend *in vitro* to 180 degrees without kinking, and in the experimental animal the irregular wall seems to function as well as a smooth one. Preliminary reports suggest that the Edwards and Tapp crimped Nylon tube is the most [illegible] The report of the American Society for [illegible] arterial homografts or vein grafts for surgery below the inguinal ligament.

Technique

Kunlin's by-pass operation, as used for a thigh thrombosis, requires a small exposure in the groin and one behind the knee through which a graft is joined to the host artery by end-to-side anastomosis above and below the diseased segment. Owen and Rob (1956) describe how the patient may be positioned so that both incisions can be performed simultaneously. The patient lies on the good side with [illegible] The graft is then passed from groin to popliteal fossa through this almost bloodless dissection The end-to-side anastomosis which is used in the by-pass operation has the advantage that the suture line represents the widest rather than the narrowest site of anastomosis, particularly if the incision into the host artery is fashioned into an ovoid Mavor (1956) reported experimental work with by-pass grafts In agreement with previous workers he found that the thrombosis rate was high when the graft was taken under the inguinal ligament

Continuous and interrupted flat-mattress sutures hold favour for the anastomosis of large and small vessels respectively, although Rob, Eastcott and Owen (1956) use a simple continuous over-and-over suture after the introduction of *mattress guides.* Kovanov (1956) reported on Russian experience with an instrument which sutures with tantalum clips: this, he claimed, could be used for end-to-end, lateral, or end-to-side anastomoses An ingenious technique for end-to-end anastomosis, using a removable prosthesis with the minimal interruption of the circulation, is described by de Villegas (1956).

Zech and his colleagues (1956) described the effects of various types of suturing on vessel growth at the anastomotic site. For this experiment growing pigs were used and a 2 centimetre strip of thoracic aorta excised and sutured back after

reversing its direction. The animals were allowed to mature and were then killed. The authors concluded that in a growing individual, non-absorbable interrupted sutures do not restrict anastomotic growth, whereas continuous sutures may do so.

The release of aortic clamps results in a precipitant fall of blood pressure which is minimized by their gradual release and often restored by blood transfusion or nor-adrenaline. In a consecutive series of 24 patients operated upon for high aneurysms or thromboses of the abdominal aorta there were 8 post-operative deaths, 6 of which occurred within the first 48 hours, and of these 3 occurred on the operation table following the release of the aortic clamps (Kenyon and Cooper, 1956)

As an additional aid Kenyon and Cooper (1956) position inflatable cuffs high on both thighs and immediately before release of the aortic clamp both cuffs are inflated to 200 millimetres of mercury. Following release of the aortic occlusion, circulation is allowed to become re-established in the pelvic and upper thigh vessels, and when the blood pressure has returned to satisfactory heights the cuffs are *alternately deflated*.

Dissecting aneurysm of the aorta is discussed by DeBakey (1956). In 10 patients he transected the aorta through the lower part of the dissecting aneurysm and obliterated the false passage in the distal end of the vessel by a continuous suture through both layers. End-to-end anastomosis was then performed between this edge and the outer wall of the proximal vessel, thus allowing the dissecting mural stream to re-enter the main channel. Seven of the 10 patients treated on these lines recovered. A similar technique was successfully used by Swann and Bradsher (1956) for a dissecting aneurysm involving the arch of the aorta.

Results

Although arterial reconstruction may be required for congenital abnormalities, *traumatic lesions, emboli and following cancer surgery*, the common problems result from arterial occlusions or dilatations subsequent to atherosclerosis. Aneurysms of the aorta carry a poor prognosis. Roberts, Danielson and Blakemore (1957), reviewing 35 patients with abdominal aortic aneurysms, reported that 19 were dead within 1 year of the diagnosis; if, in addition, the aneurysms are known to be rapidly enlarging, becoming tender or leaking, resection and reconstruction are certainly indicated. Although such procedures may be time consuming, particularly if the aneurysm extends, as it occasionally does, above *the renal vessels* (DeBakey, Creech and Morris, 1956) the results have been generally satisfactory (DeBakey, Cooley and Creech, 1955; Humphries, de Wolfe and LeFevre, 1956; *Eiseman and his colleagues, 1956) both as regards immediate mortality*, patency, and long-term results. The experience of Rob, Eastcott and Owen *(1956) is representative* and of 36 resections, 3 of which were emergency procedures for leak or [illegible]

aorta (Leriche's syndrome) may give rise to surprisingly few symptoms. *If, however*, the nutrition of the *legs is threatened or claudication is so severe as to be an* economic handicap resection of the occluded aorta and *iliac arteries may be*

followed by a "breeches" graft. There is general agreement that in most patients arterial continuity can be restored at a very small risk

Short segmental thromboses in the iliac arteries may be excised and grafted although a disobliteration may be equally satisfactory.

The commonest site for the development of advanced degenerative disease in the periphery is at the level of the adductor opening, and from there the clot spreads further into the popliteal or femoral arteries; it is unfortunately quite clear that the most unsatisfactory results in direct arterial surgery have been in such vessels. Thrombosis occurred in 16 of the 19 patients in whom low femoral or popliteal occlusions were excised and arterial continuity restored by homografting (Horton, 1956). Rob, Eastcott and Owen (1956) reported only 17 patent vessels after 37 end-to-end arterial grafts for femoral artery thromboses.

In the extensive exposure required to demonstrate the thrombosed segment, a considerable amount of collateral circulation may be destroyed, and impaired wound healing or gangrene result if early thrombosis ensues Because of this, Kunlin's by-pass operation has been widely adopted as an alternative procedure. *Crawford and his colleagues (1955) feel that this operation is indicated for long* segment femoral thrombosis, and using homografts in 24 patients failure only occurred in 3. Linton (cited by Rob, Eastcott and Owen, 1956) reported a thrombosis rate of 1·5 per cent with end-to-side anastomosis in iliac, femoral and popliteal thromboses. Szilagyi, Whitcomb and Smith (1956) review their experience with 120 homografts for aorto-iliac and femoro-popliteal occlusive arterial disease. Twenty-three clotted after operation and during the next 33 months 21 more grafts failed. The discussion which followed this paper and the report of the American Society for Vascular Surgery illustrate that experience in other centres, both with end-to-end and end-to-side anastomoses, has been less satisfactory than that of Crawford and his colleagues and of Linton Several factors demand attention as causes of early or late failure in grafting limb vessels. The surgeon may be technically at fault by creating a kink or stricture at the anastomotic site or by bad suture technique. The disease may be rapidly progressive and new thromboses will occur elsewhere in the limb. The type of graft may encourage thrombosis or be technically difficult to handle. At present, homografts and crimped Nylon seem to be most successful.

Selection of cases

Possibly the greatest factor which determines success or failure is the selection of patients In the authors' opinion grafting of peripheral arteries should be considered only when claudication is an impossible handicap or where loss of the limb from ischaemia seems likely In such patients the popliteal artery is often much involved by atherosclerosis and the final anastomosis, even when performed end-to-side, has a small diameter and the arterial blood carried by the graft has a proportionately poor outflow. The results in these patients are likely to remain poor because of the advanced nature of the disease.

AMPUTATIONS FOR VASCULAR DISEASE

Several authors have criticized the common practice of routine mid-thigh amputation for diabetic and atherosclerotic gangrene. Thigh amputees for vascular disease

rarely return to a gainful occupation; most of them are confined to a bed or chair and require the nursing care of a member of the family. In 50 patients suffering from gangrene of the feet associated with atherosclerosis and diabetes, below-knee amputations allowed 81 per cent of the stumps to be suitable for prostheses (Smith, 1956). Kendrick (1956) advised against below-knee amputation in the presence of marked flexion contracture of the knee, infection or gross nutritional skin change in the flap region, or grossly inadequate blood supply as from a recent major arterial occlusion. If such cases were rejected, first intention healing was obtained



FIG. 12.—A transmetatarsal amputation for gangrene of the toes due to atherosclerosis in a woman aged 73 years

in 32 out of 53 below-knee amputations for gangrene, with delayed healing in another 11. Kendrick recommended a short anterior and long posterior flap with immaculate haemostasis and skin apposition. Contrary to usual practice he often uses an above-knee pneumatic tourniquet until the leg is severed.

McKittrick and his colleagues (1949) reported their experience with the use of the trans-metatarsal amputation in diabetic patients with arterial insufficiency. On reviewing their experience, these authors believed that in this group mid-metatarsal amputation will seldom be successful unless the gangrene can be localized by bed-rest and conservative measures, until all active infection has been brought under control by antibiotics or surgical drainage, and until rest-pain is absent.

In over 300 amputations selected by these criteria two-thirds healed with an average hospital stay of 46 days. They recommend that a thick plantar flap is fashioned long enough to cover the end of the metatarsals which are transected just proximal to their heads. The dorsal skin is left attached to the metatarsals

without undercutting. The foot is supported post-operatively by a padded back splint and the sutures left in for 2–3 weeks (Fig. 12).

In the diabetic patient with a peripheral neuropathy, plantar or toe infections may cause local or extensive tissue necrosis even in the presence of a normal blood supply. Wheelock, McKittrick and Root (1957) believed that mid-tarsal resection is particularly valuable in this group in order to avoid the repeated ulceration and necrosis of the forefoot to which they are so liable.

PORTAL HYPERTENSION

Management of acute haemorrhage

The best method of managing massive haemorrhage from the oesophageal or gastric varices associated with portal hypertension is as yet undecided, but there is agreement that the mortality of the initial bleed in this condition is probably in excess of 60 per cent (Ravdin, 1957). When the diagnosis is beyond doubt, and it must be remembered that bleeding may come from a concomitant peptic ulcer (Mathewson, 1956), many surgeons endeavour to control the bleeding by oesophageal and gastric tamponade with the Sengstaken oesophageal tube (Sengstaken and Blakemore, 1950) While bleeding is being controlled it may be desirable to evacuate blood from the intestinal tract by cathartics injected via the tube into the stomach and by colonic washouts, in order to reduce the chances of hepatic coma (McDermott, Wareham and Riddell, 1956). Although bleeding can generally be arrested by the balloon, recurrence of haemorrhage may occur as soon as it is removed Furthermore, its presence can cause tracheal displacement and pulmonary atelectasis. If it rises into the pharynx total obstruction of the airway may result.

In discussing these problems O'Sullivan and Payne (1956) stated that an emergency porta-caval shunt should be performed as soon as possible after bleeding is controlled, the only contra-indication being pre-existing hepatic failure. In their series of 9 patients 3 died following operation. They pointed out that transpleural approach to the oesophagus with ligation of the varices (Crile, 1953; Linton and Warren, 1953) and gastro-oesophagectomy (Shumacker and King, 1952) are formidable procedures. Altemeier, McElhinney and MacMillan (1955) concluded that ligation of the splenic and hepatic arteries is contra-indicated in acute haemorrhage; both its immediate and delayed mortality are higher than that of venous shunt.

Interval surgery

When a patient has recovered from oesophageal haemorrhage surgical intervention is indicated in many cases to prevent recurrence. Most authors (Jordan, Patton and Benson, 1956, Linton and Ellis, 1956; Milnes Walker, 1957) recommend the construction of a venous shunt, and the end-to-side porta-caval anastomosis is most favoured It is of interest to note the experimental results of Patton, Lombardo and Lyons (1956) in dogs with normal and carbon tetrachloride damaged livers; the presence of a porta-caval shunt resulted in elevated blood-ammonia levels which were higher when an end-to-side rather than a side-to-side anastomosis had been performed Welch and Ramos (1957) reporting on the results of 40 venous

shunts over the past 6 years gave an operative mortality of 10 per cent in their last 20 patients; recurrence of haemorrhage occurred in 20 per cent of their cases, almost exclusively in those on whom spleno-renal shunts had been performed. They suggested some of the reasons why this is so: there are many tributaries to the splenic vein and trauma to it during dissection is not inconsiderable; kinking and angulation are definite problems and the existence of a small splenic vein favours thrombosis and closure of the shunt.

In the series by Milnes Walker (1957), consisting mainly of porta-caval shunts, the operative mortality was 6 per cent and only 3 of 47 patients leaving hospital



FIG. 13.—Splenogram of a patient with cirrhosis of the liver.

after the construction of the anastomosis had a further bleed: these had either thrombosed a spleno-renal anastomosis or undergone previous splenectomy.

Porta-venous shunts are contra-indicated in patients with severe liver dysfunction and the most satisfactory single criterion is probably the serum albumin level which must be above 3 grammes per 100 millilitres if shunting is contemplated (Linton, 1951; Milnes Walker, 1957; Ravdin, 1957); furthermore, ascites should be absent and jaundice minimal. When these conditions do not obtain some lesser procedure to reduce the risk of recurrent oesophageal bleeding, such as endoscopic injection, may be used (Macbeth, 1955).

Whether porta-venous anastomosis for demonstrable oesophageal varices is indicated in the absence of bleeding is debatable. Figures are not available to indicate the chances of haemorrhage in such patients but the mortality figures of patients having their first bleed are considerable and have persuaded some (Ravdin, 1957; Welch and Ramos, 1957) to advise operation. Others (Palmer, Brick and Jahnke, 1954) prefer to treat these patients conservatively in view of the operative

mortality and post-operative morbidity of shunt procedures. The surgeon must also bear in mind the possibility of oesophageal varices being unassociated with portal hypertension (Morton and Whelan, 1954).

Thrombosis of the portal vein as determined by splenic or operative phlebography (Du Boulay, Green and Hunt, 1957) and direct inspection excludes a porta-caval anastomosis, and in such patients a spleno-renal shunt may be considered.

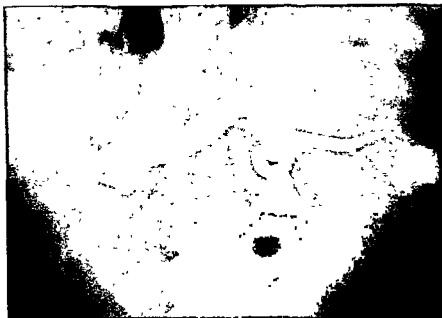


FIG 14 —Splenogram of a patient with portal vein thrombosis demonstrating anastomotic vessels.

This operation, for reasons previously stated, is generally considered to be less satisfactory than a porta-caval anastomosis. Where even the splenic vein is not available for grafting, Clatworthy, Wall and Watman (1955) have divided and anastomosed the inferior vena cava to the superior mesenteric vein in 2 cases; haematemesis recurred in 1 of these patients—a child aged 2 years.

Hepatic coma

The haemodynamic effects in the liver following porta-caval shunts have been studied by Bradley and his colleagues (1953) who found that hepatic blood flow falls by approximately one-third. Hepatic oxygen consumption, however, remains unaffected as the oxygen extraction rate is increased. These findings are confirmed by Nardi (1955) who recorded similar blood-flow alterations following spleno-renal anastomoses. It is not surprising, therefore, that Macpherson, Owen and Innes (1956) substantiate their initial findings that shunt operations are not deleterious to hepatic function. Nevertheless, there is no doubt that up to 20 per cent of patients suffer episodic neuropathic changes, sometimes ending in so-called hepatic coma (Milnes Walker, 1957).

The neuropathic complications of hepatic disease may be precipitated by a

massive oesophageal haemorrhage as well as follow shunting operations. The clinical syndrome is characterized by disorientation, flapping tremor, clonus, ataxia, excessive salivation followed by stupor, coma, convulsions and even death (Ravdin, 1957). This condition is associated with, but not necessarily directly due to, a rise in the level of blood ammonia. Occasionally, even when blood-ammonia levels have been lowered, the patient may not recover from coma (McDermott, Wareham and Riddell, 1956). Such a rise is particularly liable to occur when a high protein meal has been taken, or it may be produced by oral methionine or during the absorption of products of intestinal blood. In the latter condition McDermott, Wareham and Riddell (1956) recommended that after the control of bleeding the intestinal blood should be removed if possible, antibiotics given to lower the activity of urea-splitting organisms in the gut (perhaps neomycin is the most rapidly acting antibiotic (Rowlands and Scorer, 1955)) and glutamic acid infused intravenously to "bind" ammonia. It has also been suggested that intravenous arginine may be helpful in this condition (Najarian and Harper, 1956). While, however, these measures may be useful for the acute case they are of little value in the chronic condition Such patients require a carefully planned dietary regime with a low protein intake (Sherlock, Summerskill and Dawson, 1956).

Blood changes and ascites

The anaemia, neutropenia, thrombocytopenia or pancytopenia which appear to be attributable to splenic over-activity subsequent to portal hypertension, may be uninfluenced by the performance of a venous shunt, although this successfully reduces the size of the spleen. Splenectomy, however, does correct the blood picture (MacPherson, Owen and Innes, 1956) and should probably be performed as part of the surgical management of the patient with portal hypertension and severe blood changes.

Surgery has little to offer the patient with ascites whether this be of post-hepatic (the Budd-Chiari syndrome) or cirrhotic origin; the newer concepts of the physiology of the condition and the multiple operations which have been devised in an attempt to alleviate it are discussed by Ravdin (1957). A high carbohydrate and high protein diet with a moderate amount of fat and added vitamins form the basis of the medical regime. A low-salt intake together with ion-exchange resins may considerably aid in the control of ascites and, although they are short lasting, mercurial diuretics may be helpful. Acetazolamide (Diamox) is best avoided as it may cause raised blood-ammonia levels and hepatic coma.

ABSTRACTS RELATING TO VASCULAR SURGERY

Artery-graft bank

Management

Sterilization of arterial grafts.—RAINS and his colleagues (1956) discuss management of an artery-graft bank, with special reference to sterilization by β-propiolactone. The decline in popularity of the homologous artery graft is not only due to the usefulness and

are flamed, the grafts washed in sterile saline solution, sterile covers applied, and the grafts stored Bacterial examinations of saline washings on primary media were made.

secondary drying The freeze-dried grafts can be sent anywhere and, reconstituted, are perfectly satisfactory. With grafts preserved by other means, a state of −70° C. (deep-frozen) or +4° C. (saline solution or formalin) must be maintained.

Synthetic arterial grafts

Teflon fabric

examined periodically for palpable femoral arterial pulsations, and were sacrificed at monthly intervals up to 3 months Additional animals were sacrificed at 6 and 12 months

Silicone-treated crimped Nylon tube

EDWARDS and TAPP (1956) describe methods of replacing peripheral arteries with chemically treated Nylon tubes At first, as described elsewhere, they used ordinary tubes of 210 denier Nylon yarn treated in a formic acid dip which partly dissolves the outer

arteries To soften the ends at operation gentle heat from a cautery is used Before use

the tube is gently manipulated and for end-to-end anastomosis a simple over and under continuous suture is preferred. The cut end of the braided tube is bevelled at 45 degrees with scissors and heat-sealed by cautery. The distal end of the artery is pulled over the tube, and care is taken to pass the needle from within outwards to prevent separation of the intima. Small longitudinal incisions in the artery ends facilitate the procedure and

[illegible]

flexion, and even in parts where flexion does not occur a stiff straight graft often fails Experiments were made to determine at which strength formic acid gave the best results The patients' ages ranged from 19 to 81 years, and the defect in the circulation was sometimes due to injury—as in the youth aged 19 years who died—or to disease. No other case was fatal Thromboses were so common in the stiff tubes that they are no longer used. Though longer observation is needed the procedure described is considered to hold great promise.

Arterial grafting

Causes of late failure

SZILAGYI, WHITCOMB and SMITH (1956) review the causes of late failures in grafting therapy of peripheral occlusive arterial disease. While early experiences with grafting gave results far superior to those obtained by medical or surgical means, it has since been observed that, post-operatively, an increasing proportion of patients lose their earlier gains. To understand late failures, 120 consecutive grafting operations have been analysed, *the results of which had been observed from 1 to 33 months.* These operations were performed on 88 patients and were both primary and secondary. The cases were selected on clinical and angiographic grounds. If the arterial trunks proximal and distal to the occlu[illegible] operative correction, exploration [illegible] forme[illegible] stances: end-to-end anastomosis [illegible]

[illegible]

7–12 months after surgery, whereas after [illegible] in 6 cases

[illegible] was [illegible]osis [illegible] pro-[illegible]on-

gressive changes were noted in the arterial substitutes. [illegible] vincing cause of failure, however, exemplified in 16 cases, was the severity of the occlusive disease process either by post-operative progression or owing to incomplete excision [illegible] the entire

[illegible]

be palliative.

Aneurysm of the thoraco-abdominal aorta

Surgical treatment

DeBakey, Creech and Morris (1956) discuss aneurysm of the thoraco-abdominal aorta involving the coeliac superior mesenteric and renal arteries, a condition in which resection may produce fatal ischaemic damage. Four such cases are reported. In all of them the aneurysm extended from the lower descending thoracic to the lower abdominal aorta, *involving the arteries already mentioned. At operation the aneurysm was excised* and replaced by a homograft. Continuity was restored to the vessels The cases and operative technique are described in detail. To overcome fatal ischaemic damage, 2 methods are available. the first involving the use of hypothermia to reduce oxygen

nature of the aneurysm demands adequate exposure, obtained by a left thoraco-abdominal approach The incision is made over the left seventh or eighth rib, extending from the mid-axillary line across the costal margin and then curving to a point well below the umbilicus After careful exploration to determine the extent of the lesion, the aorta is exposed above and below the aneurysm, and these segments, together with the major visceral branches, are encircled with tape to control haemorrhage. Further, to expose

are undertaken, and continuity is restored in the aorta and involved arteries by a well-fitting homograft. Following completion of the final anastomosis of the graft to the thoracic aorta, the shunt is removed and the openings in the aorta are sutured. Considerable variations exist in the period of tolerance of the kidney to anoxia. In the first case, the patient died from renal failure one week after operation In the others, the use of temporary shunts successfully reduced the period of temporary arrest of circulation to the abdominal viscera In these cases, the period of occlusion in the renal arteries varied from 15 to 46 minutes; in the coeliac artery from 44 to 116 minutes, and in the superior mesenteric artery from 36 to 102 minutes

Dissecting aneurysm of the aorta

Surgical treatment

Dissecting aneurysm of the aorta is discussed by DeBakey (1956) In 75 per cent of

one as close as possible to its point of development By thus shortening the false passage peripheral resistance to the flow of blood is reduced and this also corrects the compressive ischaemic action of the false passage on the points of origin of the major vascular channels of the abdominal aorta If the condition starts below the left subclavian artery then excision of the diseased part and use of an aortic *homograft may be possible. In*

10 patients treated on the lines described 7 recovered. The results in these were most gratifying. Two patients died from rupture after one week and 1 from ventricular fibrillation, probably due to pneumothorax and hypothermia.

Axillary-brachial artery

Closed traumatic lesions

ROB and STANDEVEN (1956) describe 8 cases of closed traumatic lesions of the axillary-brachial artery. Four of these arose from the use of an axillary crutch for nearly 50 years. The symptoms of numbness, pain, loss of sensation, and absence of radial pulse on the affected side, were common to all cases. The first 2 illustrated sudden complete occlusion of the artery. In the third case, partial occlusion of the artery, an embolus lodging in the radial artery, and ascending thrombosis were the sequence of events. Sympathetic ganglionectomy was performed in these 3 cases with success. In the fourth case, an unpadd crutch produced a fusiform aneurysm of the lower axillary artery and recanalization of a occlusion of the brachial artery. Ganglionectomy was again successful. The remaining cases were due to injury, but the symptoms were similar. In one of these, resulting from a blow on the arm just below the axilla, thrombosis of the brachial artery was diagnosed. The affected segment was excised and an autogenous venous graft inserted. Thrombosis developed in the graft, and ganglionectomy was performed. Subsequent secondary haemorrhage necessitated ligation of the subclavian artery. Ganglionectomy in another traumatic case of brachial thrombosis proved successful. In a further case, traumatic arterial spasm occurred after a fracture of the humerus. The posterior humeral circumflex artery was torn from the axillary artery with contusion and thrombosis. The affected segment was excised and a homograft inserted. Convalescence was normal and results were good. The last case was also of this type, rupture of the axillary artery being treated by end-to-end anastomosis. In every case recovery was satisfactory. In the management of occlusion, several factors are of importance. gangrene is less likely to supervene than in the femoral artery; the site and extent of the block have a significant bearing on the final disability, the rate of occlusion largely determines the fate of the limb. In cases of acute onset, treatment should prevent spread of thrombosis and should dilate the collateral vessels quickly and effectively. In cases seen days or weeks after onset, sympathetic ganglionectomy is advocated. Thrombo-endarterectomy is usually only successful in larger vessels.

Obliterative arterial disease

Indications for direct surgery

EISEMAN and his colleagues (1956) discuss indications for direct arterial and aortic surgery in obliterative disease. In this study of 67 patients, elective factors are considered. Every stage of arterial obliteration and obstruction were observed, from minimal narrowing to complete obliteration of the abdominal aorta distal to the renal arteries. Signs and symptoms of muscle ischaemia were found in the back, buttocks, thighs, calves and feet. Of the 67 patients, only 24 were operated upon, with a mortality of 2. Even in abdominal aortic resection, morbidity is slight, provided the graft remains patent; if, however, clotting occurs the position is reversed and amputation may become necessary. In individual cases it is often difficult to gauge the adequacy of the collateral compensation; the aorta may be totally obliterated, but the collateral vessels adequate to minimize distal ischaemia. In selecting candidates for operation, the ratio between progression of the disease and the age of the patient is a useful factor. If symptoms of ischaemia develop slowly after the age of 50 years, advanced obliterative disease of the small arteries of the extremity with a maximum number of collateral vessels are to be expected. If symptoms develop rapidly, however, particularly in a younger patient, the distal vessels are more likely to be adequate, the collaterals less well-developed, and the viability of the limb more seriously threatened, operation is therefore probably indicated. Since atherosclerosis may involve the cerebral, coronary and renal vessels, operative risk, prognosis and post-operative activity in each case must be considered, the third factor presenting the greatest problem. Advanced co-existing atherosclerosis is a major contra-

indication to surgery; concentration of the disease in one segment of the abdominal aorta constitutes the ideal case for operation. Since success depends upon the status of the vessels distal to the by-passed or excised section of the artery, evaluation of distal vessel disease is essential. Methods of evaluation include clinical examination of the distal portion of the extremity, radiography of the vessels, and their direct exploration at operation.

Translumbar aortography

Complications

The complications occurring in translumbar aortography are described by McAfee and Willson (1956) They note that these are sometimes serious, and the present review is based on 150 cases seen locally and those recorded in the English and the available [illegible]

spleen have been seen. Experiments by renal function tests, however, made soon after aortography have not often indicated any loss of efficiency, though the literature contains notes of 8 cases of oliguria or anuria from failure of excretion The accidental injection of the medium into the renal artery does not inevitably cause renal damage though it necessarily makes it more likely. In 1 patient, temporary hypertension and poor renal function were noted for some weeks. Bleeding from the aortic puncture site is another hazard as haematoma formation with pain in the loin and shock may occur. This is rare, but in 1 patient with a luetic aortic aneurysm, operation to deal with the haemorrhage after its discovery proved fatal. In cases in which the superior mesenteric artery has been injected direct some disasters occurred when sodium iodide was used—death occurring from shock. The more recently developed iodine compounds do not involve this risk. If the medium is extravasated round the aorta, signs of irritation may develop and may be very painful, though rarely fatal. There is dispute concerning the effects of these [illegible]

technique as when a pillow under the abdomen compressed the aorta with consequent ischaemic changes in the spinal cord.

Portal hypertension

Treatment by hepatic artery ligation

[illegible]

were given for 5–7 days pre-operatively. Through a midline incision the peritoneum was opened and the coeliac axis revealed. The hepatic and splenic arteries were ligatured 1–2 centimetres from the coeliac axis; in 9 patients, the left gastric artery was also tied,

the pressure in the portal vein being determined before and after each ligation. A fall in portal venous pressure of 10–40 millimetres of water occurred after ligation of the hepatic artery in patients with initial pressures above 320 millimetres; after ligation of the splenic artery there was an additional fall of 30–100 millimetres; no significant fall followed ligation of the left gastric artery. Recurrent haemorrhage from oesophageal varices in 6 cases was fatal in 2. Of 13 patients with pre-operative ascites and oesophageal haemorrhage, 11 survived 4½ months, with no recurrent ascites; 6 had no further bleeding; all showed improved hepatic function. Three patients with cirrhosis died within 3 months of operation from liver failure; this condition probably contra-indicates ligation. The immediate post-operative mortality was 11·1 per cent; the overall mortality, 50 per cent in a 3½-year period, these results comparing unfavourably with those of venous shunting. The procedure, however, appears to be of value in ascites, since there was no recurrence in patients surviving 4½ months. The operation should be reserved, therefore, for patients with proved Laennec's cirrhosis complicated by portal hypertension, either ascites or a history of oesophageal haemorrhage, and in whom intensive medical therapy to correct the liver changes has been attempted.

Classification and surgical treatment in infancy and childhood

Portal hypertension in infants and children is discussed by JORDAN, PATTON and BENSON (1956). They used the usual classification into pre-hepatic, hepatic and post-hepatic causes, the last of these being the most difficult to treat surgically. When there is atresia of the portal vein the cause is usually inborn and it is thought that after the collapse of the umbilical vein and of the ductus venosus soon after birth, the obliterative process may spread to the portal vein itself. As a corollary to this theory one may find an explanation of the occasional discovery of a stenosis of the inferior vena cava at the entrance of the ductus venosus. Cirrhosis of the liver is not rare in children and infants, its origin being obscure, and this may cause block within the organ. The cases seen by the surgeon are often those which bleed from the upper intestine, those with secondary splenic enlargement, or both signs together. Endoscopy will sometimes provide further evidence but may cause bleeding so that measures to deal with it should be made ready. If tamponade of the oesophagus stops the bleeding and clear fluid returns from the lower stomach, much useful information is gained. It is more than ever clear that, to distinguish between the hepatic and the post-hepatic groups the portal system should be outlined and percutaneous injection of the radiographic medium can safely be performed short before operation. Though bleeding from the oesophagus is usually a result of port hypertension it may at times arise from local varices without morbid changes elsewhere. In children and infants splenectomy, to relieve portal hypertension, is not desirable, but for conditions other than this it is permissible if the portal vein is patent. The writers feel that even if portal hypertension is found without clinical features, or a history of bleeding, a splenorenal shunt is nevertheless indicated, for the liver is usually normal and can stand the strain of a diversion, keeping the portal vein intact. Nine cases were seen and all the evidence suggested that when the disease was of hepatic or post-hepatic origin a shunt operation between the splenic and renal veins gave excellent results.

The complexity of liver disease

Hepatic circulation, portal hypertension, ascites and ammonia metabolism

RAVDIN (1957) discusses the complexity of liver disease on the basis of the hepatic circulation, portal hypertension, ascites and ammonia metabolism. Its dual afferent blood supply distinguishes the liver from all other organs, while its extensive collateral circulation is functionally significant. The pressure relationships of the hepatic artery and portal vein are unique, the pressure at the junction of the two systems being only 3–4 millimetres of mercury, equilibrium being established somewhere within the hepatic parenchyma. In cirrhotic liver destruction, the tiny radicals of the portal and hepatic veins are phenomenally distorted. The liver therefore depends mainly for its blood supply upon the hepatic artery, extensive communications developing between its branches and the portal vein and between the tributaries of the portal and hepatic veins, these intrahepatic shunts

diverting a large portion of the portal blood into the systemic circulation. Venous shunts [illegible]

retention after 45 minutes in the bromsulphalein test. The effects of venous shunting on liver function have been challenged; nevertheless, good results in 82 per cent cases have been obtained To the perplexing problem of ascites, the latest contribution is the role of the sodium ion, demonstrated by the dramatic therapeutic response to restriction of dietary sodium intake. An increased K : Na ratio in the sweat and saliva of ascitic patients, moreover, suggests that ascites formation may be related to adreno-cortical hyperactivity. Although ascites has been attributed to portal hypertension, recent cumulative evidence suggests that obstruction of the hepatic venous outflow tract, rather than blockage of the portal venous inflow tract, is the responsible factor, and that when ascites is reversible obstruction to the outflow tract will respond to medical treatment. A diet rich in carbohydrate and protein protects the liver from toxic injury, and this diet, with the addition of fats, vitamins and lipotropic substances, forms the basis of modern [illegible]

third The problem of ammonia intoxication and hepatic coma is intriguing. In 1954, MacDermott reported the toxic capacity of nitrogenous substances to produce the episodic stupor following portacaval shunting and, with his colleagues, later clarified the question of the body metabolism of ammonia The sources of this ammonia are the gastro-intestinal tract, the kidney and the de-amination process in protein metabolism. The equally important cellular metabolism of ammonia suggests its chemical conversion by the brain to a bound form not yet detectable, two of the many chemical reactions involved appearing to be glutamine synthesis and the "ammonia-binding mechanism", the integrity of the latter probably being more significant than the ammonia blood level. Therapy therefore aims at eliminating the sources of ammonia and supporting the natural mechanism by which the body removes it.

Hepatic coma

Treatment and prognosis

SHERLOCK, SUMMERSKILL and DAWSON (1956) discuss the treatment and prognosis of hepatic coma Treatment is based on the concept that a toxic nitrogenous substance formed in the intestine by bacterial action is in part responsible for the altered cerebral metabolism. Sixty-six patients with liver disease and hepatic or prehepatic coma were treated; they included an acute group with biliary cirrhosis and acute neuropsychiatric episodes, a chronic group with well-compensated cirrhosis and a large portal systemic collateral circulation, and a miscellaneous group. The neurological status was classified as follows (1) minor disorders of consciousness and of the motor system; (2) gross disorder of consciousness with disorientation in time and space; (3) coma. Ammonia levels in the peripheral venous blood and nitrogen balances were estimated. Therapy involved emptying of the intestines and keeping them free of all nitrogen-containing [illegible]

allowed in uncontrollable cases. Haemorrhage from oesophageal varices was a common precipitant. Haemorrhage with coma necessitated use of the oesophageal compression balloon, and blood transfusion kept the haemoglobin level above 10 grammes per 100 millilitres. Intravenous sodium glutamate was given in 12 cases without improvement. Of the

66 patients, 48 reached deep coma; of the 39 survivors, 21 had been in deep
patients with hepatic cirrhosis, 17 recovered; of 13
vived. The 13 chronic cases surviv
diet for 2–22 months withou
albumin levels. In the miscella
than in acute virus hepatitis,
Younger patients and women ... neither age nor sex ... prognosis was better ... of serum-
patients and men. Prognosis with cirrhosis withstood ... was better in cirrhosis
an unexpected finding. Prognosis was unaltered ... sex was an influential factor
state, unrecognized ... To be successful ... treatment was ... deep coma better than
im
12
bili
pre
asso
... coma indicating ... and serum-albumin levels ... it was assessed by the
factors hardly seemed to affect a bad prognosis. In acute hepatitis, failure of function
Controllable factors, however, improve the prognosis, while in cirrhosis, the reverse was the case.
as a complicating factor of established hepatic coma was always fatal. ... precipitating ... Gastro-intestinal haemorrhage

Bacteriology of the portal vein

Investigations by an original method

TAYLOR (1956) carried out investigations
by culturing, its bacterial content.
cystectomy, a plastic tube was passe
the portal vein itself. A heparin drip
it was easy to take blood samples as
tip of the tube a venogram was taken. ... to m
mesenteric vein but this was considered to be of e
portal vein. A brain-heart infusion broth ... Sometimes th
were taken from 21 patients. Of these
samples no growth occurred and in c
contaminations. Nothing was seen at c
these 10 samples differed appreciably from the ... to suggest that the 6 patients producing ... but one were
there was no clinical evidence that their post-operative ... other patients observed
normal course. Two patients
to the experiment
had no ap
carries bac
There is n
ulcerative c
taken hourly
is extremely

REFERENCES

Diagnosis of vascular disease

Bahnson, H. T., and Nelson, A. R. (1956). *Ann. Surg.*, 144, 519.
Bonney, G. (1956). *J. Bone Jt Surg.*, 38B, 686.
Hiertonn, T., Lindberg, K., and Rob, C. (1957). *Brit. J. Surg.*, 44, 348.
Jepson, R. P. (1956). *Circulation*, 14, 1034.
— (1957). *Ann. R. Coll. Surg. Engl.*, 20, 249.
Kinmonth, J. B. (1948). *Lancet*, 2, 717.

Mavor, G E. (1956). *Brit. J. Surg.*, **43**, 352.
— (1957) *Ibid.*, **44**, 337.
Rob, C. G., and Standeven, A. (1956). *Lancet*, **1**, 597.
Schein, C. J., Haimovici, H., and Young, H. (1956). *Surgery*, **40**, 428.

Arterial trauma
Crawford, E. S., Beall, A. C., Moyer, J. H, and DeBakey, M. E (1957). *Surg. Gynec. Obstet.*, **104**, 129.
Crawford, T. (1956) *J. Path Bact.*, **72**, 547.
Gaylis, H., and Laws, J. H. (1956) *Brit. med. J.*, **2**, 1141.
Henson, G. F., and Rob, C. G. (1956). *Brit. J. Surg*, **43**, 561.
Lindgren, E. (1953) *Acta Radiol*, *Stockh.*, **39**, 205.
McAfee, J. G, and Willson, J. K. V. (1956). *Amer. J. Roentgenol*, **75**, 956

Arterial grafting
Buchanan, J. L, and Marrangoni, A. G. (1955). *Surgery*, **38**, 999.
Creech, O, Jordan, G L., and DeBakey, M E. (1957) *Surg. Gynec. Obstet.*, **104**, 385.
— — — Overton, R. C., and Halpert, B (1955) *Ibid*, **101**, 607.
— DeBakey, M. E., Cooley, D. A, and Halpert, B. (1956). *Ibid.*, **103**, 147.
Edwards, W. S, and Tapp, J. S (1956). *Surg. Gynec Obstet.*, **102**, 443.
Fisher, E. R., and Fisher, B. (1956). *Surgery*, **40**, 530.
Girvin, G. W, Wilhelm, M. C., and Merendino, K. A. (1956). *Arch. Surg.*, *Chicago*, **72**, 879.
Julian, O C., Deterling, R. A, Su, H. H, Dye, W S., and Belio, M. L. (1957). *Surgery*, **41**, 50.
Linton, R. R., Shumacker, H, Julian, O. C., Deterling, R. A., Edwards, S, and Creech, O. (1957) *Surgery*, **41**, 62.
Moore, T. C., Riberi, A., and Kajikuri, H (1956). *Surg Gynec. Obstet.*, **103**, 155.
Rains, A. J. H, Crawford, N, Sharpe, S. H., Shrewsbury, J. F D, and Barson, G. J. (1956). *Lancet*, **2**, 830
Rob, C. G., and Eastcott, H. H. G (1953). *British Surgical Practice* (*Surgical Progress*), p 1. London, Butterworth.
— — and Owen, K. (1956) *Brit. J Surg*, **43**, 449.
Sewell, W. H, Koth, D. R., Pate, J. W., and Bedell, W. C. (1956). *Amer J. Surg.*, **91**, 358.
Taber, R. E., Goslin, F. B., Ehrenhaft, J. L, and Tidrick, R. T. (1956) *Arch. Surg*, *Chicago*, **72**, 644.

Technique
DeBakey, M E (1956) *Surg Gynec Obstet* [illegible]
Kenyon, [illegible]
Kovanov, [illegible]
Mavor, C [illegible]
Owen, K [illegible]
Rob, C. G, Eastcott, H. H. G, and Owen, K. (1956) *Brit. J. Surg*, **43**, 449.
Swann, W. K., and Bradsher, J. T. (1956) *New Engl J. Med.*, **255**, 36.
deVillegas, L D (1956). *Surgery*, **40**, 1035.
Zech, R K, Nyhus, L. M, Griffith, C. A, and Harkins, H. N (1956). *Amer. J. Surg*, **92**, 462.

Selection and results
Crawford, E. S, Creech, O, Cooley, D. A, and DeBakey, M. E. (1955). *Surgery*, **38**, 981.
DeBakey, M E, Cooley, D. A, and Creech, O (1955) [illegible]
Surger [illegible]
— Creech, [illegible]
Eiseman, B, Raine [illegible]
Chicago, **73**, 41[illegible].

Horton, R E. (1956). *Brit. med. J.*, **1**, 81.
Humphries, A. W., de Wolfe, V. G., and LeFevre, F. A. (1956). *J. Amer. med Ass*, **161**, 953.
Linton, R. R., Shumacker, H., Julian, O. C., Deterling, R. A., Edwards, S., and Creech, O (1957). *Surgery*, **41**, 62.
Rob, C. G., Eastcott, H. H. G
Roberts, B., Danielson, G.,
Szilagyi, D. E., Whitcomb, J.

Amputations
Kendrick, R. R. (1956). *Brit. J. Surg.*, **44**, 13
McKittrick, L S. (1949). *Ann. Surg.*, **130**, 826
Smith, B. C. (1
Wheelock, F. C F. (1957). *Surgery*, **41**, 184.

Management of acute haemorrhage
Altemeier, W. A., McElhinney, W. T., and MacMillan, B G. (1955). *Arch. Surg., Chicago*, **71**, 571.
Crile, G (1953). *Surg Gynec. Obstet*, **96**, 573.
Linton, R. R., and Warren
McDermott, W V., **144**, 318.
Matheuson, C (1956
O'Sullivan, W. D., a (1956). *Surg Gynec. Obstet.*, **102**, 668.
Ravdin, I. S. (1957). *Ann. R. Coll. Surg. Engl.*, **20**, 71.
Sengstaken, R. W., and Blakemore, A. H. (1950). *Ann. Surg*, **131**, 781.
Shumacker, H. B, and King, H. (1952). *Arch. Surg., Chicago*, **65**, 499.

Interval surgery
Clatworthy, H. W, Wall, T, and Watman, R. N. (1955). *Arch. Surg., Chicago*, **71**, 588.
DuBoulay, G. H, Green, B, and Hunt, A. H. (1957). *Brit. med J.*, **1**, 189.
Jordan, P, Patton, T. B, and Benson, C D. (1956) *Arch. Surg., Chicago*, **72**, 879.
Linton, R. R (1951) *Ann Surg.*, **134**, 433.
— and Ellis, D. S (1956) *J. Amer. med. Ass.*, **160**, 1017.
Macbeth, R (1955). *Brit med J.*, **2**, 877.
Milnes Walker, R (1957). *Lancet*, **1**, 57.
Morton, J H, and Whelan, T J. (1954) *Surgery*, **36**, 1138.
Palmer, E. D., Brick, I. B, and Jahnke, E. J. (1954). *New Engl. J. med*, **250**, 863.
Patton, T B, Lombardo, C R., and Lyons, C. (1956). *Ann. Surg.*, **143**, 588.
Ravdin, I. S (1957) *Ann R. Coll Surg. Engl.*, **20**, 71.
Welch, C S, and Ramos, A. G. (1957) *Surgery*, **41**, 756.

Hepatic coma
Bradley, S E, Smythe, C. M., FitzPatrick, H. F., and Blakemore, A. H. (1953). *J clin. Invest*, **32**, 526.
MacDermott, W V, Wareham, J, and Riddell, A. G. (1956). *Ann. Surg.*, **144**, 318
Macpherson, A I S, Owen, J A, and Innes, J. (1956). *Lancet*, **1**, 353.
Milnes Walker, R. (1957). *Lancet*, **1**, 57.
Najarian, J S, and Harper, H. A. (1956). *Amer J. Med.*, **21**, 832.
Nardi, G L (1955) *Arch Surg, Chicago*, **70**, 530.
Ravdin, I S (1957) *Ann R. Coll. Surg. Engl.*, **20**, 71.
Rowlands, B C, and Scorer, E. M. C (1955) *Lancet*, **2**, 950
Sherlock, Sheila, Summerskill, W. H J, and Dawson, A. M. (1956). *Lancet*, **2**, 689.

Blood changes and ascites
Macpherson, A. I. S., Owen, J. A., and Innes, J. (1956). *Lancet*, **1**, 353.
Ravdin, I S (1957). *Ann. R. Coll. Surg. Engl*, **20**, 71.

Bacteriology of the portal vein
Taylor, F W. (1956) *Arch. Surg., Chicago*, **72**, 889.

PROGRESS IN ENDOCRINE SURGERY

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The subject of endocrinology, which 20 years ago was relatively unimportant and considered by some a little disreputable, now finds itself very much in the limelight. Disorders of the thyroid gland still account for the major part of endocrine surgery, but researches into the normal and abnormal physiology of the pituitary, adrenals and parathyroids have resulted in many more operations upon these glands.

Most of the advances in this field are reported in journals devoted to the basic sciences or endocrinology and metabolism, and the application in the field of surgery may not at first be apparent. For this reason some of the articles abstracted at the end of this section are not surgical, but their relevance will become apparent in this brief review of the year's progress.

THE THYROID

Hashimoto's thyroiditis

The outstanding advance in our knowledge of thyroid disease during the current year has been the work on Hashimoto's thyroiditis, which has been shown to be due to an auto-immune reaction of the body's tissues in response to the patient's own thyroidal colloid. Cooke and Wilder (1954) have described how they obtained markedly abnormal liver function tests in cases of Hashimoto's disease, and Cooke and Luxton (1955) again drew attention to their views about Hashimoto's disease. They pointed out that the condition is commoner than is generally supposed, the preponderance of cases occurring in middle-aged females with symptoms of subthyroidism of variable degree with a thyroid gland easily felt and abnormally firm. Often the patient reported to her doctor for symptoms not readily ascribed to thyroid disturbance such as lassitude, muscle and joint pains, increasing weight and changed facial appearance. The basal metabolic rate was subnormal in most of the patients when first seen, although a minority showed signs of hyperthyroidism Anaemia was not a characteristic feature. The liver function test which was most consistently abnormal, was the colloidal gold test, although thymol-turbidity

and flocculation tests generally ran parallel with it. Serum alkaline phosphatase was only slightly or moderately raised. These abnormal findings were all reversed when treatment with dried thyroid was continued for a prolonged time; they noted that the size of the thyroid diminished steadily at the same time.

Auto-antibodies

Roitt, Doniach, Campbell and Hudson (1956) announced their findings of auto-antibodies in this condition. A number of workers had already shown that patients with Hashimoto's disease have high serum gamma globulin levels which accounted for the abnormal flocculation tests. These raised gamma globulin levels, their delayed return to normal after thyroidectomy and the infiltration of the thyroid with lymphoid tissue, lymphocytes and numerous plasma cells, suggested that an immune response might be the cause. They tested this hypothesis by subjecting the sera of patients with Hashimoto's goitres to saline solution extracts of normal and thyrotoxic human thyroid glands, and obtained heavy precipitation with the untreated Hashimoto patients and not with any other. They went on to establish the fact that the antibodies were organ-specific to the thyroid gland. They then used a purified human thyroglobulin and found similar precipitins and thus put forward the hypothesis that it was the thyroglobulin in the thyroid to which the body became sensitized.

Sensitizing with injections of own thyroid

Unknown to these workers, Witebsky, Rose and Shulman (1955) had been working in America with rabbits, sensitizing these animals to injections of their own thyroid glands. Witebsky obtained very distinctive histological changes in the thyroid glands of his rabbits and when these were inspected by Riggs, who is well versed in thyroid work, he immediately pointed out that the changes were extremely similar to those seen in Hashimoto's disease in humans. The story thus appears complete and we may conclude that patients with Hashimoto's thyroiditis are immunized against their own thyroglobulin and this leads to a progressive destruction of the thyroid gland with infiltration and replacement by lymphocytes and lymphoid tissue. One of the earliest changes in the parameters of thyroid function is defective organic binding of iodine and Morgans and Trotter (1957) have described how potassium perchlorate will discharge a recently given tracer dose of radio-iodine from a Hashimoto thyroid while having no such effect on the normal thyroid.

What are the implications of these findings? The first is that this condition ... part of the ... in ... of ... a all the clinical and biochemical aspects of this disease with special reference ... of their own cases. Next, it is not necessary to operate upon a patient ...

of the condition is clearly that of giving thyroid by mouth in adequate doses, to be continued for the rest of the patient's life. By so doing, the gland becomes smaller and softer, thus relieving the patient of any discomfort; simultaneously the otherwise progressive hypothyroidism is relieved and the patient returns virtually to normal

It appears that there are exceptional forms of this disease and the gland may grow to an enormous size or appear to infiltrate local tissues For example, Sholl and Black (1954) report a patient with a superior vena caval syndrome resulting from a huge retrosternal goitre which was the site of typical Hashimoto's disease. Whether or not such an enormous gland could be reduced to normal size by thyroid therapy seems doubtful, but certainly such a patient would require replacement therapy with thyroid hormone for the rest of her life.

Needle biopsy

Needle biopsy, as described at the end of this article (Hamlin and Vickery, 1956), is a technique which is likely to become much more popular in diagnosing thyroid conditions. Hamlin uses the split needle, which is one commonly used for liver biopsy, with the patient lying on a couch with the neck extended and the skin infiltrated with a few drops of lignocaine. The present author has used this method on many occasions and has so far had no complications and no haematomas. Firm pressure should be applied for a few minutes after withdrawing the needle and a satisfactory specimen can be obtained in about 80 per cent of cases. The greatest value of this technique lies in the diagnosis of thyroiditis, but it is also useful for providing histological confirmation of anaplastic thyroid carcinoma without having recourse to general anaesthesia and operation, thus permitting the early start of radiotherapy.

Nodular goitre

The interest in nodules in the thyroid gland, especially solitary ones, continues unabated and the problem which usually confronts the surgeon is whether the lesion is simple, malignant or toxic. A review of the whole subject, by the present author, appeared in 1956 and the reader is referred to this for greater detail than can be included here

Johnson (1955) of Melbourne has carried out careful studies of the blood supply of normal and nodular human thyroids. His technique was to perfuse them with saline solution after their removal at operation or in the post-mortem room. The result was to open up tissue planes with oedema and show that basically the gland is lobular in structure, each lobule being composed of some 20–40 follicles bound together with light connective tissue. A single artery supplies each lobule and this explains why a group of follicles tend to behave as a single unit. The evolution of nodules in simple goitre has been previously described by Taylor (1953), using an autoradiographic method, and this would explain the appearance of hyperplasia in nodules at an early stage of their existence and the fact that later they are often inactive and may contain little iodine. Ross (1956), in a review of the clinical aspects of such nodules, found malignancy in about 10 per cent and evidence of toxicity in 4 out of 76. Continued observation of 150 patients for 10 years showed

that after careful excision of the nodule together with adjoining thyroid tissue, no further nodules could be detected clinically.

Treatment with thyroid extract

The reason why such nodules appear in the first place is a problem which still remains unsolved, but the possibility that it might be due to an increased secretion of thyrotropic hormone (T.S.H.) or local sensitivity to the hormone has been recently postulated by Zondek and Leszynsky (1956). They founded their theory on observations made on a boy aged 17 years and his sister aged 12 years who had familial sporadic cretinism with goitre and were treated with triiodothyronine. The bulky nodular glands were made to regress and the nodules virtually to disappear. When the treatment was stopped, nodules recurred in precisely the same place as before, yet readministration of thyroid extract produced regression as before. Localized areas of increased sensitivity to thyrotropic hormone are put forward as the reason for the nodules. That a goitre may indeed recur is stressed by Piercy and Lange (1957) who review 118 patients they have treated with true recurrence. Most of these goitres were seen in women, especially at the menopause and with anxiety states. Those who were hypothyroid showed shrinkage of the swelling when given dried thyroid by mouth; re-operation was advised in all those patients in whom pressure symptoms occurred. Where there was evidence of recurrent laryngeal nerve injury or tetany having followed the first operation, radioactive iodine treatment was favoured. A distinction is not drawn between those who were previously toxic and those who were non-toxic.

Which nodules should be removed?

There are so many non-toxic nodular thyroids in the world that it would be impossible to pursue a policy of perfection and excise them all. Even allowing for the fact that some 10 per cent of the single nodules may prove, on histological examination, to be malignant and that a proportionately smaller number of the multi-nodular ones are also malignant, it is still not possible—nor even desirable—to offer surgery to all of them. Many criteria have been established in the past to guide the surgeon in choosing those patients in whom he should perform a thyroidectomy. Rapid increase in the size of the gland, hardness, a feeling of discomfort in the patient's neck, and lymph node involvement are all urgent indications that surgery is necessary. Perlmutter and Slater (1956) discuss some of the other reasons for removing nodular goitres. They first point out that it is impossible to calculate from existing figures the exact frequency of malignancy in thyroid nodules, although it would appear that somewhere between 7 and 12 per cent of solitary nodules and 3·5 and 8 per cent of multi-nodular ones examined are carcinomatous. They also add that, before operation, it is impossible to say with complete certainty if nodules are single. They rely very much on the fact that malignant tissue takes up little, if any, radioactive iodine in contradistinction to normal thyroid tissue and they therefore survey the neck with a Geiger counter before operation. One of the difficulties with this technique is that the patient may have been taking iodide, as for example in the form of a cough mixture, and this will suppress the radioactive iodine uptake. Occasionally a nodule is found with a radioactive iodine uptake greater than the remainder of the gland, although the patient is

euthyroid (that is, of normal thyroid function). Treatment with thyroid hormone reduces the uptake of radioactive iodine in such patients and this type of hyperactive nodule can usually be made to regress.

Nodular, goitre in childhood (*see* Fig. 15)

The problem of nodular enlargement of the thyroid gland in children, which is a very great rarity, has been thoroughly reviewed by Hayles and his colleagues (1956) of the Mayo Clinic who have collected records of 130 such children who have been seen at their centre in the last 50 years. From 1908 to 1919 only one carcinoma was detected in this group, but from 1950 to 1955 70 per cent of nodular goitres removed from children were found on histological examination to be malignant. The most common histological pattern seen was that of microfollicular and macrofollicular adenomas sometimes presenting papillary hyperplasia. Less common was the foetal adenoma; Hashimoto's disease was rare. Hayles and his colleagues recommended surgical treatment for all cases of nodular goitre in children because the incidence of carcinoma is high, being usually of the papillary or follicular type or both They state that such tumours are frequently slow-growing, metastasizing to the regional lymph nodes so that surgical excision offers a good



Fig. 15.—Child, aged 4 years, with congenital non-toxic goitre.

prognosis. Radiotherapy is contra-indicated since the lesion is not usually radio-sensitive and the risk of inducing a malignant change by irradiating the thyroid in childhood appears very real (*see* the section on thyroid cancer, page 146).

Squamous-cell cysts.—An unusual cyst which may occur in the thyroid is one lined by squamous cells and containing yellow pultaceous material. Goldberg and

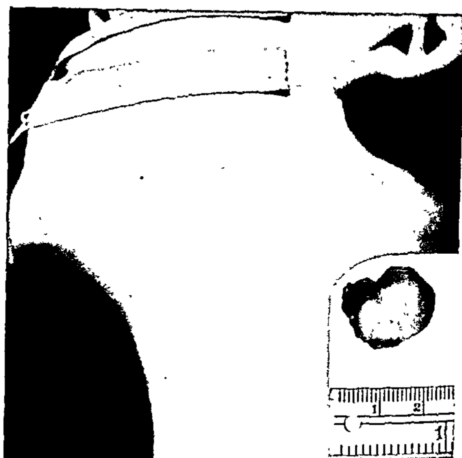


FIG. 16.—Squamous-cell cyst of thyroid in a boy aged 7 years. *Inset.* The cyst, yellow in colour, after removal from the left upper pole of the thyroid.

Harvey (1956) review two cases of these cysts which they removed and which showed characteristic keratinous epithelial whorls, and the present author has removed one from a child (*see* Fig. 16) almost identical with that illustrated in Goldberg's paper. The problem arises as to where the squamous cells come from, are they some form of developmental remnant or do they occur as a result of metaplasia? The authors favour the former, and suggest the fourth branchial complex or the ultimobranchial body as the source of squamous material.

Mediastinal goitre

Johnston and Twente (1956) have reviewed the literature on this subject and define what constitutes a true mediastinal or intrathoracic goitre. They conclude that the overwhelming majority have descended into the chest from the neck and

this also applies to the five recorded ones which reached the diaphragm, all of them having a blood supply arising from the inferior thyroid vessels. A golden rule to remember is that when only one lobe of the thyroid is much enlarged in the neck, one should suspect that the opposite lobe has enlarged out of sight in a downward direction; a radiograph will show if this is so.

These authors also discuss the best surgical approach to mediastinal goitre.

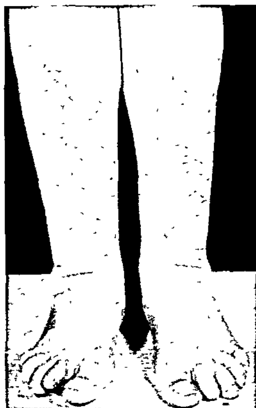


Fig. 17.—Pretibial myxoedema Typical appearance of raised indurated plaques in lower third of legs

They have given up the transthoracic route as it makes it difficult to define the blood [illegible]

more inaccessible ones in the anterior mediastinum and to divide the second and third costal cartilages for those in the posterior mediastinum. The present author agrees wholeheartedly with these conclusions only adding that it will be found very rarely necessary to split the sternum if a thoroughly wide cervical approach is made

Hyperthyroidism

No fresh theories have appeared recently to account for the development of hyperthyroidism, but there is no diminution in the development of new ways of

controlling the disease, so that the major problem confronting the surgeon today is the decision as to which is the best *form of therapy for* any particular patient.

The antithyroid drugs

Carbimazole (*Neo-mercazole*).—This drug has now proved itself to be the antithyroid drug of choice for most patients with hyperthyroidism. Its dosage is approximately one-tenth of that of methylthiouracil and there is a definitely lower incidence of toxic reactions. Burrell, Fraser and Doniach (1956) have reported on 1,046 patients who have been treated with this drug and they find an incidence of major reactions of only 0 48 per cent. Drug fever was commoner than agranulocytosis with this drug in contradistinction to methylthiouracil, with which lowering of the white cell count is relatively more common. Greene and Morgan (1956) report on 181 patients treated with carbimazole and compare them with 261 treated along similar lines with methylthiouracil. For pre-operative treatment the drug has many advantages, originally pointed out by D. Doniach, in that the thyroid does not usually enlarge and is not so friable or vascular as with other antithyroid drugs. The addition to this pre-operative treatment of iodine in the form of Liquor Iodi Aquosus (Lugol's solution) in the last 10 days or 2 weeks before operation, offers at the present time the best method of preparing the toxic thyroid for elective surgery.

Potassium perchlorate.—This continues to be used in increasing amounts in the management of hyperthyroidism (Crooks, 1957). First described in this connexion by Wyngaarden in 1952, it has been introduced into clinical usage in doses of 100–200 milligrams three or four times a day with no toxic effects other than mild dyspepsia (Morgans and Trotter, 1954). Its mechanism of action is totally unlike that of the thiouracil type of drug in so far as it prevents the accumulation of iodide by the thyroid in contradistinction to preventing synthesis *of thyroid* hormone It proves most valuable in the long-term medical treatment of hyperthyroidism with drugs where surgery or radioactive iodine are contra-indicated.

Thyroidectomy

In a review of the management of thyrotoxicosis Riddell (1956) pointed out the importance of first assessing the degree of hyperthyroidism, and stressed that in its milder forms the disease responds very well to conservative measures. The more severe degrees are classified as to whether *(1) the hyperplasia is diffuse* in the thyroid gland, (2) confined to one nodule, or (3) associated with a number of nodules. Whenever possible toxic nodular goitre requires thyroidectomy for its treatment, since the results are lasting and cannot be equalled by any form of medical care. Where the hyperplasia is diffuse, mild degrees may respond to long-term antithyroid therapy or the patient may be prepared with iodine and then subjected to thyroidectomy. More severe degrees of the disease require the use of an antithyroid drug, but it must not be given in such large doses that the gland becomes larger and more vascular. Additionally, the administration of iodine before operation is called for. This produces a much firmer gland, a much less vascular gland and one which is not so friable at operation. Patients who have been rendered myxoedematous by antithyroid drugs need proper correction before operation, as myxoedema is itself a definite contra-indication to surgery.

Mortality rate.—The operation of thyroidectomy has become much safer in the last 10 years, this is probably because of the introduction of the antithyroid drugs for the preparation of the patient for surgery. Beahrs, Ryan and White (1956) reviewed the mortality rate among their patients and noted that it was 0 7 per cent in 5,402 thyroidectomies prior to 1946, a figure which fell to 0·1 per cent in 8,972 surgical procedures after 1946. The largest number of deaths occurred in patients

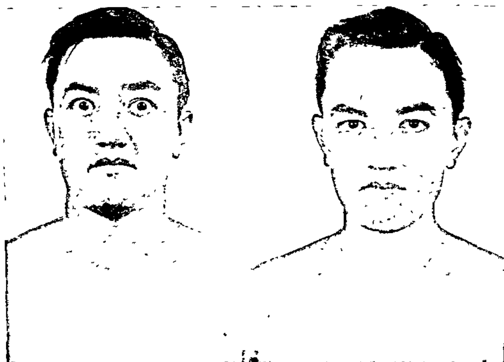


FIG. 18 —Patient before and after treatment with radio-iodine Intolerance to antithyroid agents made it impossible to bring him to a safe operative state.

(*By courtesy of the editor of Brit J Surg*)

suffering from toxic nodular goitre and who represented the poorest risk. The complications of surgery included paralysis of the vocal cords in 1·3 per cent of cases and tetany in 0·2 per cent.

Radioactive iodine therapy (*see* Fig. 18)

The use of radioactive iodine for treating hyperthyroidism has become more general during the last year and the indications for its use are beginning to crystallize (Pochin, 1957). In most clinics it is reserved for patients over the age of 45 years because of the possible risk of inducing a malignant change, and it has proved most successful in diffuse toxic rather than nodular goitre.

The first patients to be treated with radioactive iodine have now been followed-up for 16 years, but very few have even been followed-up for 12 years so that 8 or 10 years must still elapse before judgment can be given on the hazard of inducing malignancy with this type of therapy.

Calculation of size of gland—The calculation of the dose required depends on

the size of the thyroid gland and the assessment of this still remains a major problem in therapy; the usual technique is to make an inspired guess as to the weight of the gland, after carefully palpating the neck. As a result, overdosage is not uncommon and myxoedema may occur in about 20 per cent of patients treated by radioactive iodine. From Lisbon, Franco and Quina (1956) describe a method for calculating the size of the thyroid gland by careful radiographs after the insufflation of 150 millilitres of oxygen into the tissues of the neck. The oxygen produces surgical emphysema, outlining the gland which can then be radiographed in two planes. The authors claim that they have reduced the error in calculating the size of the gland to about 10 per cent.

Hyperthyroidism in childhood

McClintock, Frawley and Holden (1956) have reviewed the treatment of hyperthyroidism in 50 children whose ages ranged from 2 to 15 years. The sex ratio was 24 females to each male and the clinical manifestations of the disease were similar to that seen in adults. These authors employed surgery in 45 cases after rest, sedation, a high calorie diet and iodide therapy as pre-operative treatment. Only one child died, the cause being given as pneumonia; tracheotomy was required on two occasions. Although these authors stress that thyroidectomy offered the most satisfactory method of treating the disease, in Great Britain prolonged medical treatment with antithyroid drugs remains the method of choice in most patients seen with hyperthyroidism before puberty. Carbimazole in adequate doses, followed by or accompanied by potassium perchlorate has proved satisfactory and is usually given for 18–24 months before being stopped. A remission often follows such a course of therapy, but even if there is reactivation of the disease, further medical treatment can be used which still does not preclude surgical treatment at a later date if a permanent remission is not obtained.

Thyroid cancer

Carcinoma of the thyroid gland continues to arouse a great deal of interest quite out of proportion to the frequency of its occurrence. The Registrar General's returns for England and Wales suggest that not more than 300–350 people die from this disease yearly, yet there have been published during the last 12 months a great many papers concerning this subject. This is in part due to the discovery that cancer develops more commonly in the thyroid after irradiation in early life (Clark, 1955; Simpson, Hempelmann and Fuller, 1955), that it is not such an uncommon malignant disease in childhood as had previously been supposed, and that under certain circumstances it lends itself to treatment with radioactive iodine.

Aetiology

1. Doniach (1956) described the induction of benign and malignant thyroid tumours in laboratory rats Like humans, those living in endemic goitre districts develop goitres which often contain nodules and are occasionally malignant. Prolonged treatment with an antithyroid agent, such as thiouracil, increased the incidence of these nodules and when in addition a carcinogenic agent, such as 2-acetylaminofluorine (A.A.F.), is given, the incidence of malignancy is much

higher. Similar results were produced by him when radioactive iodine was given in addition to the antithyroid agent. The common factor in all the experiments appeared to be the raised output of the pituitary thyrotrophic hormone and it is, of course, possible that similar factors might be at work in man. Clark in Chicago and Miss Simpson in Buffalo reviewed all their cases of thyroid carcinoma in children and found that a large number of them had received x-radiation to the neck or upper chest in earlier childhood, usually for so-called thymic hyperplasia. All of the 15 children aged under 15 years with thyroid cancer reported by Clark had previous radiotherapy to the neck or upper chest in doses of only 200–725 roentgen, administered at an average age of 6·9 years The importance, therefore, of not irradiating the neck area in childhood is thus underlined.

Doniach (1956) also referred to the fact that thyroid carcinoma is about ten times more common in areas of endemic goitre than in other parts of the world. This is shown by the figures available from Switzerland where, in a population of about four million people, approximately the same number of deaths are recorded from this disease each year, that is, a little over 300, compared with 300–360 in about forty million people resident in England and Wales. The incidence in Switzerland is slowly lessening as the effects of iodized salt begin to make an impression on the goitre problem (Wynder, 1952).

Pathology and natural history

The importance of a careful pathological study of thyroid carcinoma was pointed out by Alhadeff, Scott and Taylor (1956) in a review of 67 thyroid carcinomas. Their classification followed closely that of Shields Warren and the three types—follicular, papillary and undifferentiated—gave a good guide to the spread, malignancy and prognosis of the respective tumours.

Papillary carcinoma.—In the younger age group, papillary carcinoma was the commonest and it tended to spread slowly and by the lymphatics. The treatment of these patients appeared, therefore, to be primarily surgical since the tumours rarely concentrated radioactive iodine and were not particularly sensitive to radiotherapy. Where the carcinoma was very well differentiated and showed limited spread, a more conservative type of operation was recommended. In this operation one lobe of the thyroid containing the tumour was removed together with the affected lymph nodes. Occasionally the tumour was more aggressive Rundle and Basser (1956) stressed the importance of radical surgery in such cases of papillary thyroid cancer, since a tumour which spreads by the lymphatics can often be eradicated if the local excision is adequate. They point out that there may be more than one primary focus within the thyroid gland and that total thyroidectomy is called for in a number of these patients. They also emphasize that post-operative radiotherapy should be avoided since it does not control the disease and makes further surgery much more difficult.

Follicular carcinoma of the thyroid.—This type of carcinoma occurs in the middle years of life and often spreads by the blood stream metastasizing typically to the bones and the lungs. When well differentiated the metastases may take up iodine and produce hormone. [illegible]

greatly distorted the neck or damaged recurrent laryngeal nerves or parathyroids, thyroid ablation by radio-iodine, using a dose of about 80 millicuries, is preferable. After this, the patient is left without substitution therapy until the stimulus of the pituitary to the metastases encourages them to take over function and this is determined by means of a tracer dose of radioactive iodine. Pochin (1957) suggests that testing for tumour uptake should take place about 7, 14 and 21 weeks after completing thyroid ablation, if a clear uptake is demonstrated in the tumour tissue at any of these times, then radio-iodine treatment is started.

Physiological considerations.—Function in the metastases may be sometimes encouraged by the injection of T.S H., with a maximum of 10 units on 4 successive days. Alternatively, the patient may be given large doses of an antithyroid drug for some 6–21 weeks, and when it is stopped for 48 hours the resultant hyperplasia may have induced or increased function as shown by the radio-iodine uptake by the tumour. The physiological considerations in the management and the aetiology of this kind of thyroid tumour is well discussed by Sonenberg (1956) who states that about half the patients selected, when given radio-iodine, receive some degree of benefit. This form of treatment, he points out, carries with it its own complications, such as pneumonitis and pulmonary fibrosis, when too large a concentration of radio-iodine appears in the pulmonary metastases, *Leukaemia may* [illegible] large doses of radio- [illegible]

glands since iodine is concentrated by these glands though not stored in them. In addition there may be suppression of menstruation due to irradiation of the ovaries and the most serious complication of all occurs when there are multiple functioning deposits in the bone marrow, for then the isotope therapy may produce a fatal aplastic anaemia.

Thyroid carcinoma in children

This rare disease has been thoroughly and exhaustively studied by Winship (1956). He has reviewed the case histories of 334 children collected from the world literature by sending questionnaires to children's hospitals in North America and in parts of Europe and by repeated visits to many of these centres He defines childhood as being under the age of 15 years and states that 20 per cent of affected children gave a history of irradiation to the thyroid in infancy. The disease appears to be commoner where medical centres take the most interest in the possibility of its occurrence and no relationship between it and goitrogenic diets was found. The most common presenting sign was a painless nodule in the neck, 15 per cent of the patients had pulmonary metastases and 8 patients had osseous metastases when first seen. A number of patients have been followed-up for many years, one as long as 27 years, and because of the protracted course which this disease sometimes runs, patients harbouring it should be followed-up for at least 20 years.

Treatment.—Majarakis, Slaughter and Cole (1956) reported 15 cases of carcinoma of the thyroid in patients aged from 5 to 20 years; 9 were females and 6 were males A third of these tumours appeared to have arisen in non-toxic nodular goitres and 7 of the patients had metastasis to the cervical lymphatic nodes when first seen. Treatment consisted of surgical ablation of the affected thyroid and lymph

nodes and in those patients with less differentiated tumours, radiotherapy was used post-operatively. After operation, the patients were given thyroid by mouth and the importance of this has been stressed by other workers during the last 12 months. This form of therapy, which was described by Sir Thomas Dunhill over 20 years ago, has at its rationale the suppression of the anterior pituitary and therefore of T S.H. production in the patient, by the giving of a generous amount of thyroid by mouth. This is intended to supplement the inadequate secretion of the thyroid tissue which is left in the patient's neck after operation and to supply even more hormone than the body requires. The dosage is increased until the bowel action is just a little free. On rare occasions, well-differentiated metastases may shrink or even apparently disappear as detected by x-rays, and Crile (1957) has recently stressed the value of this form of therapy

The treatment of the undifferentiated thyroid carcinomas has received little attention recently and radiotherapy appears to be the best form of therapy at the present time A convenient method of determining the diagnosis is provided by the use of split-needle biopsy, which is mentioned earlier in this section and has been well described by Hamlin and Vickery (1956). An illustrated account of its use will be found in British Surgical Progress 1955 (page 154).

Exophthalmos (*see* Fig. 19)

The exophthalmos problem remains unsolved, but many aspects of it are well reviewed by Dobyns (1956) in a recent article on Graves' disease. He refers to his own work on the separation of an exophthalmos-producing substance (E.P.S) from the thyroid stimulating hormone (T S.H), in anterior pituitary extracts. He



Fig. 19.—Exophthalmos. Note the forward protrusion of eye-ball and retraction of swollen eye-lids

describes how it may be assayed in Fundulus, a small Atlantic minnow which responds with exophthalmos when suitable material is injected into the coelomic cavity. Certainly these minnows respond when injected with the serum of patients with severe exophthalmos and this may prove to be a useful method of assay. Further evidence for the existence of E.P.S. is to be found in a description by Jackson (1956) of a remarkable patient with various endocrine manifestations. This woman, at the age of 28 years, after the birth of her second child, developed exophthalmos and mild hyperthyroidism for which she underwent thyroidectomy. Subsequently myxoedema appeared and though treated with thyroid the exophthalmos worsened and lactation continued for 8 years. A further pregnancy occurred and lactation ceased. It would appear that the secretion of T.S.H., E.P.S. and prolactin by the anterior pituitary did not run parallel.

Fortunately progressive exophthalmos is often a self-limiting process and though it may proceed in one or both eyes for months or years, it ultimately stops, fortunately often before the loss of an eye. The accompanying ophthalmoplegia is less easily treated and there is a shrinking of the field of vision which may eventually leave the patient with such a limited central field, that he must swing his head round in order to see objects which lie only a little to one side.

Treatment

Large doses of desiccated thyroid are still recommended, probably because it depresses the anterior pituitary and therefore, presumably, the secretion of the exophthalmos-producing substance. Also in part because it acts as a diuretic and probably reduces the water tension in the tissues. The eyes can be protected by suitable glasses with wide side-pieces and by sewing the lids together at the outer margin, an operation referred to as tarsorrhaphy. There have been a few recent reports of hypophysectomy and stalk section for malignant exophthalmos, but it seems unlikely that such radical measures will find a place in the treatment of this condition. Rowbotham and Clarke (1956) describe a new method of orbital decompression to relieve progressive exophthalmos and describe their results in 30 cases. Both the superior and lateral walls of the orbits were removed and no eyes were lost. They remarked that at operation the ocular muscles were bulky and pale and there was an excess of orbital fat.

THE ADRENALS

Bilateral adrenalectomy still remains in vogue for the treatment of advanced metastatic disease arising from carcinoma of the breast and approximately 50 per cent of patients are benefited by this technique and may expect a remission up to a maximum of about 3 years. The removal or destruction of the pituitary however, has supplanted adrenalectomy and oophorectomy to an increasing extent and the choice between these two forms of therapy is discussed in the section devoted to the pituitary (page 155). The management of the patient before and after adrenalectomy has become routine and no new advances have been reported recently in this particular field. Clain and Hunt (1956) have reported a successful outcome in 2 patients with intracranial metastases from breast cancer after bilateral adrenalectomy and oophorectomy. This procedure has previously been in disfavour for

brain secondaries, but the excellent remissions these authors describe, especially as one patient had an expanded pituitary fossa, suggest that this therapy may be preferable to hypophysectomy under these circumstances.

Adrenalectomy

A new approach for the removal of both adrenals without having to move the position of the patient has been described by Aird and Helman (1955). Using an incision which runs transversely across the upper abdomen, Aird approaches the right adrenal directly and the left one after reflecting forwards the spleen and colon. In the thin and emaciated patient, who is the usual subject for this operation, the approach is convenient and not difficult. It allows the ovaries to be removed at the same time and the patient does not have to be moved, which may be a matter of great importance if there are many secondary deposits in the spine which might lead to fracture or dislocation with movement under general anaesthesia The lateral approach, where each adrenal is to be removed individually, or the posterior approach where both have to be inspected at the same time, are preferable when the patient is large and obese, as in those suffering from Cushing's disease.

Cushing's disease

This rare condition still attracts much attention, especially as it now appears to be so amenable to surgical treatment, and the availability of cortisone for the after-care makes the operation safe.

Cope and Raker (1955) have reviewed a large series of such patients and the disease was considered in a meeting at the Royal Society of Medicine during 1956. The general consensus of opinion was that total adrenalectomy was preferable to subtotal removal, because the risk of recurrence when only a small fragment of the adrenal had been left behind was very real. In addition it was now possible to give the patient adequate replacement therapy after operation and there was thus no great danger in removing all of both adrenals. Opinion differs as to the best approach, some favouring the lateral route and exposing one adrenal at a time, others placing the patient face down in the jack-knife position and removing both adrenals at the same operation. The advantage of this technique, which is championed by Cope and Raker and is also used by the present author, is that both adrenals can be inspected before starting the removal of either, and the possibility of a tumour being present is therefore catered for. Some 10 per cent of these patients have an adrenal cortical tumour, the removal of which cures the patient.

Aldosteronism

In 1954 Conn of Ann Arbor first described a new clinical syndrome which he named primary aldosteronism as the result of remarkably astute deduction He postulated that just as Cushing's disease represents an increased secretion of glucocorticoids by the adrenals and the adrenogenital syndrome results from increased secretion of androgens, so patients with severe potassium loss and sodium retention might well represent a condition in which there is oversecretion of the sodium-retaining or mineralocorticoids As a result of this deduction he persuaded

his surgical colleague, Baum, to operate on a patient with such a syndrome; an adrenal tumour was discovered, removal of which completely corrected the patient's disease. A number of such tumours have now been successfully excised, two of them by Aird at the Postgraduate Medical School of London, and others in various parts of the world. When the condition has been left untreated for a long time damage results to the renal tubules and then, even if the tumour is removed, the patient is unable to return to a normal state. It would appear that patients suffering from this disease will be discovered if the condition is considered in those who present with periodic attacks of muscle weakness and hypokalemic alkalosis unexplained by other conditions. A serum potassium and bicarbonate estimation performed routinely on all hypertensive patients might lead to more of these tumours being recognized.

Adrenogenital syndrome

Wilkins of Baltimore (Grumbach and Wilkins, 1956) has clarified our understanding of this condition as it is seen in childhood. The disturbance is congenital and often familial and may present in the female as pseudo-hermaphroditism and in the male as precocious pseudo-puberty. The aetiology of the condition is common to both sexes, the difference lying only in the type of sex precocity which is induced. The condition appears to be due to an inborn error of adrenal metabolism in which the gland is incapable of synthesizing the C.21 steroids. As a result, hydrocortisone is not produced and the anterior pituitary pours out more ACTH. This leads to bilateral adrenal hyperplasia and an excessive amount of the C.19 and C.21 precursors appear in the serum. Since the C.19 steroids are the androgenic ones, the male characteristics in either sex are accentuated with a correspondingly raised level of 17-ketosteroid excretion.

In the female child the clitoris is enormously hypertrophied and the genitalia appear at first sight to be male If the baby survives, this virilizing process proceeds through childhood with precocious appearance of pubic and axillary hair, acne and other male characteristics. In the male, precocious puberty appears sometimes at as early an age as 5 or 6 years with large male genitalia and body hair. Treatment, as Wilkins pointed out, is readily carried out by giving cortisone by mouth and he describes a large series of children who have developed normally on this régime. Not only is the virilizing process completely arrested, but the blood pressure also falls to normal and there appears no reason why these children should not develop into normal adults. Surgery is definitely contra-indicated as adrenalectomy is very poorly tolerated under these conditions.

In the adult, virilism may be acquired and is then the result of an adenoma or bilateral hyperplasia of the adrenal cortices. Under such circumstances the treatment is surgical and the tumour must be removed, or subtotal or total adrenalectomy carried out.

Adrenal insufficiency

Now that our knowledge of the hormones of the adrenal has been so widened, it is possible to understand why certain patients coming for surgery, especially those who have been chronically ill for a long time, do not respond normally to the trauma of the operation. Howland and his colleagues (1956) reviewing the patients

at the Memorial Center in New York who had undergone surgery for cancer, found 25 who showed signs of adrenal cortical insufficiency following surgery. This took the form of unexplained hypotension, with failure to respond to blood replacement or vasoconstrictors and respiratory depression with a prolonged reaction time after anaesthesia. They found that this insufficiency could be treated during operation, or immediately thereafter, by means of cortisone, ACTH or an aqueous

of saline solution.

Adrenaline and nor-adrenaline

Hammond, Aronow and Moore (1956) have estimated the levels of nor-adrenaline in the serum of patients undergoing surgery and those who have been shocked by burns or other trauma They found that the levels did not follow those of the other adrenal steroids and the levels often remained unaffected by anaesthesia, operation, or even removal of the adrenals themselves. In two patients with severe burns, marked rises in the adrenaline and nor-adrenaline levels were noted.

Hormone replacement therapy

Hart (1956) reviewed the replacement of hormones and pointed out that the most dangerous form of acute adrenal deficiency now met with is in the adrenalectomized patient, or in the intact patient whose adrenals have been suppressed by cortisone therapy and who then undergoes a sudden major stress such as trauma, operation or infection. Death may occur within 48 hours unless intravenous hydrocortisone or large doses of oral cortisone are immediately administered. For this reason he emphasized that adrenalectomized patients should be told of this possibility, and the method, now gaining general usage, of giving patients a card to carry with them stating that they have had their adrenals removed, may prove life saving. He described in detail the management of patients before and after adrenalectomy and reviewed the newer therapeutic substances such as fluorohydrocortisone and Δ-fluorohydrocortisone.

Argentaffinoma and serotonin

In 1952 Biorck, Axen and Thorson in Malmo drew attention to a striking clinical syndrome of flushing with cyanosis, diarrhoea, pulmonary stenosis and occasional asthmatic-like attacks associated with metastasizing ileal argentaffinoma Argentaffinomas or carcinoids are most commonly encountered in the appendix, but do not usually cause any particular effects. When present in the terminal ileum they are often multiple and when malignant may metastasize and give rise to the picture described above. The substance secreted into the blood stream is 5-hydroxytryptamine or serotonin. A discussion on this subject will be found in the *Proceedings of the Royal Society of Medicine*, June 1957, and it is interesting to note that patients almost certainly demonstrating this syndrome were presented at that Society by Maurice Cassidy some 30 years ago.

Carcinoid tumours of the appendix and small bowel are typically yellow, but naked-eye appearances are not diagnostic and histological examination is necessary.

Dukes (1946) has shown that most rectal and large bowel carcinoids are benign. Their outstanding characteristic is the slowness of their growth and if they do metastasize the secondaries also are compatible with long periods of survival. One characteristic feature of argentaffinomas which have metastasized and produced serotonin is *the increased and continuous activity* of the gut, which is unrelated to obstruction and leads to increased borborygmi.

PARATHYROIDS

Hypoparathyroidism

This condition is most likely to be encountered when the parathyroids are removed at thyroidectomy. It is often difficult to identify these tiny glands and if they are removed the patient complains of tingling in the hands and feet about the third or fourth day after operation, carpopedal spasms follow and the patient may be quite distressed. Buckwalter and his colleagues (1955) reviewed a number of patients showing this condition and pointed out some of the ways of avoiding it and methods of treatment when established. The immediate treatment of tetany due to hypoparathyroidism is the intravenous injection of 10 millilitres of 10 per cent calcium gluconate. Often the condition is transient as one of the glands probably remains although its blood supply may for a while be disturbed. In time it may start to function again normally and take over the duty of all four glands. Patients with tetany or latent tetany are helped by large doses of calcium by mouth and this may suffice to give them a serum calcium level at which they are symptom free. When this treatment is not adequate they require calciferol, starting with an [illegible] in similar doses to the original effective dose of calciferol.

Hyperparathyroidism

This condition still continues to be overlooked and is probably much more common than is generally realized, as is stressed by Crawford, Stefanelli and Alvarez (1956). They describe 3 patients who presented in an unusual way with hyperparathyroidism, and *their account is most instructive in pointing out the* various ways in which this disease may mislead the clinician. Their first patient was a child who started limping when aged three years and radiographs revealed what appeared to be a simple bone cyst in the trochanteric area. The cyst was cleared out and filled with bone chips which healed satisfactorily, *but the material* removed suggested osteitis fibrosa cystica and a serum calcium of 12·4 milligrams per cent was obtained. Limping later returned and further radiographs showed other areas with cystic changes; eventually a benign adenoma of one parathyroid was removed with lasting benefit.

Their second patient, aged 30 years, developed pathological fractures in one arm and both legs, while there was also a history of digestive trouble 6 years previously. After laboratory studies a diagnosis of parathyroid disease was made and an adenoma removed at operation. Three years later, when the fractures *had healed*

well, a haematemesis made admission to hospital again necessary, and an ulcer was seen on the lesser curvature of the stomach for which partial gastrectomy was performed A further haematemesis suggested stomal ulceration and a test meal showed a continuing high acid curve. It was not until further radiographs revealed fresh areas of rarefaction in the bones, together with calcification of arteries, that a further exploration of the neck was carried out and two further parathyroid adenomas removed. It should always be remembered that unusual and intractable cases of peptic ulcer may in fact be due to parathyroid disease and the serum calcium should therefore always be determined in such patients.

The third patient, a woman aged 41 years, had a long history of limb pains and lassitude and for a few weeks showed a swelling of the premaxilla. A neoplasm was suspected and a benign giant cell epulis was removed. The urinary calcium was repeatedly found to be high, but the bone marrow was normal although calcification was noted in some of the blood vessels and rarefaction seen in the bones. At operation a malignant parathyroid adenoma was removed, but the patient eventually died of bronchopneumonia and uraemia, with calcification in the kidneys

These 3 patients well illustrate the different ways in which hyperparathyroidism may present and stress the fact that careful serum calcium studies, repeated at regular intervals should be made whenever a suspicion of the disease is entertained. Approximately 10 per cent of patients with hyperparathyroidism show hyperplasia of all four parathyroids and, less commonly, adenomas may be multiple. Finally the possibility of the parathyroid tumour being in the mediastinum must be remembered, as approximately 10 per cent of these tumours are not found in the usual sites.

PITUITARY

The surgeon's main interest in the pituitary gland at the present time is in its destruction in advanced cases of metastatic malignant disease, especially those resulting from a primary lesion in the breast. It has been discovered that hypophysectomy gives at least as good results as bilateral adrenalectomy in advanced breast cancer and Atkins and his colleagues (1957) has reported two series of patients, the one treated by hypophysectomy and the other by adrenalectomy and oophorectomy with some evidence that the former group have responded better. The results however are not statistically significant.

The technique of carrying out the hypophysectomy has varied widely in different centres. Falconer (1957) and Radley-Smith (1957) have both reported on the surgical ablation of the gland by a transfrontal approach. They point out the difficulty of removing all the tissue and various methods of completing this have included mopping out the sella with Zenker's fluid, the introduction of radioactive material such as yttrium and the introduction of plastic discs. Forrest and his colleagues (1956) in Glasgow have described their technique of introducing radon and, more recently, yttrium into the hypophysis by means of cannulae introduced through the nose under x-ray control. Radiation damage to the optic tract has been minimized by the introduction of yttrium which has a shorter range than radon and which is more suitable for the destruction of the pituitary.

Patients in whom the hypophysis has been destroyed, show the signs of lack of the trophic hormones which control adrenal and thyroid metabolism. For this reason they require cortisone and thyroid by mouth. One of the earliest hormonal effects is the appearance of diabetes insipidus and the severity of the polyuria depends on the dose of cortisone used. Loss of sight due to injury to the optic tract and cerebrospinal rhinorrhoea, occasionally with meningitis have been the main hazards, but these have been minimized in more recent cases.

THYMUS

Thymectomy still remains a useful procedure in myasthenia gravis, between half and two-thirds of the patients showing improvement of varying degree. Griffin, Nattrass and Pask (1956) describe a most unusual case of myopathy and myasthenia gravis of very gradual onset, which eventually resulted in the patient suddenly stopping breathing. Artificial respiration and the use of a respirator kept the patient alive for 36 days when thymectomy was carried out. Full respiratory power returned and he was later able to resume work, only requiring small doses of ephedrine thrice daily

Interest has also centred in the thymus as a result of the suggestion that Hodgkin's disease arises in this gland and that it is primarily of thymic origin (Thomson, 1955). The treatment of Hodgkin's disease, however, still remains largely one of palliation by means of radiotherapy, and agents such as nitrogen mustard and thio-tepa.

ABSTRACTS RELATING TO THE ENDOCRINE GLANDS

Thyroid gland disorders

Although the present prevalence of non-malignant thyroid disorders is unknown, it is certainly much lower than that of 20 years ago, when an estimated 9 per 1,000 of the population of the United States of America were affected, cases of cancer of the thyroid now number about 5,000. In the National Health Survey of 1935-36, thyroid gland disorders caused an incidence of disabilities lasting for 1 week or longer of only 0 6 per 1 000 persons a year; a survey in 1954 showed that there were 2,227 deaths, of which [illegible] (hyperthyroidism). These con- [illegible] foods and the use of iodized salt. Toxic goitre, in contrast, has [illegible] reduced; [illegible] especially [illegible] results [illegible] methods [illegible] they have ever been.

Thyroiditis

Diagnosis and treatment

oedematous. Symptoms included enlargement of the neck, difficulty in breathing and swallowing, nervousness, fatigue, coughing, hoarseness, local pain and tenderness In 26 patients, at operation, the thyroid was adherent to the trachea and strap muscles. Ultimately involving one or both lobes and the isthmus, the condition is degenerative, the epithelium finally being replaced by fibrous tissue which may encompass the gland. Small tumours often yield to administration of desiccated thyroid extract; unsightly goitres, those producing pressure symptoms or suggestive of carcinoma, require lobec-

suspected carcinoma, lobectomy or subtotal thyroidectomy is indicated Riedel's struma, also of unknown aetiology, is a chronic inflammatory process involving one or both lobes, the trachea and surrounding structures When unilateral, the tumour is indistinguishable from carcinoma In long-standing cases, scar tissue constricts the trachea and operation to relieve the symptoms of tracheal constriction is justifiable In bilateral cases, surgery may be hazardous and the method of Lahey, with removal of the isthmus and as much as possible of each lobe, is recommended.

Hashimoto's disease

Auto-antibodies

ROITT and his colleagues (1956) discuss auto-antibodies in Hashimoto's disease, in which high serum-gamma-globulin levels[1—3] produce abnormal flocculation tests of liver function Patients, however, who had undergone thyroidectomy 6 months to 22 years previously showed normal levels and flocculation tests in most instances In 2 patients

saline extracts of normal and thyrotoxic glands were carried out. The former gave precipitins, the latter negative results. To determine whether the antibodies were organ-specific, saline extracts of the thyroid and other organs were tested against the serum of a

thyroglobulin with the antibody in the circulation.

Diagnostic and biochemical aspects

[illegible]

characteristics served to distinguish lymphadenoid goitre from non-toxic nodular goitre [illegible]

order to determine the effect of removal of the goitre on the serum proteins. Results showed that in most cases the serum proteins returned to normal after several months; in 2 cases, proof was obtained of [illegible] to normal values after operation [illegible] closely associated with the presen[illegible] deficiency. It is further suggested that the raised serum gamma globulins represent an immune response to an antigen released by the goitre. Further studies have shown that the serum of patients with Hashimoto's disease contains a precipitating antibody which reacts specifically with human thyroglobulin.

Needle biopsy of the thyroid gland

Technique and results

Needle biopsy of the thyroid gland is described by HAMLIN and VICKERY (1956). They remark that diagnosis in thyroid disease is difficult and only a small proportion of cases sent to the surgeon are rightly labelled. Needle biopsy of the thyroid has been performed by others and the writers stress that it is only performed by them in selected cases, not as a routine. Under local anaesthesia they make a small incision through the skin and introduce a trocar and cannula with a rotary motion and tangential to the trachea towards the goitre. When it is judged to be resting against the thyroid the trocar is removed and a split needle inserted through the cannula into the gland substance. The needle is then held and the cannula is turned forward until it encloses the needle with its contents. Both are then turned together and withdrawn, firm pressure being applied to check bleeding. So far few complications have occurred and in a group of 175 patients adequate material was thus obtained in 130. In their experience the writers have found frequent difficulty in distinguishing between chronic thyroiditis and nodular goitre. In 6 of the cases thus examined unsuspected cancer was found, three of these being secondary deposits from primaries elsewhere. The specimens obtained are about 2 centimetres long and 2 millimetres in diameter at their greatest, which is not a large amount for the pathologist. The clinical data must always be sent to the laboratory as it may only be possible to say that the material examined is consistent with the diagnosis. It was found that in a quarter of the specimens too little was available to permit a pathological opinion to be given. With the multilobular goitre there may be so many thin-walled cysts that the tiny fragments of these seem like normal tissue. It is also found that with the solitary nodule the method described is too uncertain to enable cancer to be excluded; diagnosis with the whole nodule available is often difficult. The greatest value of the procedure is in cases of thyroiditis.

Thyroid adenomas

Genesis

ZONDEK and LESZYNSKY (1956) discuss the genesis of thyroid adenomas. Diffuse and nodular thyroid enlargements are attributed to changes in the secretion or activation of the thyrotrophic hormone, irrespective of the primary cause. The tendency of this enlargement to be local rather than uniform is investigated in a boy aged 17 years and his sister, aged 12 years, with familial sporadic cretinism and goitre. Both had voluminous, diffuse goitres, with nodules varying in size from cherries to plums; both showed typical myxoedema. A total dose of triiodothyronine produced disappearance of the myxoedema and [illegible]

[illegible] diminution but not disappearance of the nodules occurring in the girl. In both patients, section of a nodule revealed colloid adenoma. It was therefore concluded that local differ- [illegible]

Clinical signs

[illegible]

is fo [illegible]
enlar [illegible]
activ [illegible]
correlation between the histological features of the tumour and its secreting activity Usually an adenoma fails either to take up radioactive iodine or to respond to drug [illegible]

maintain [illegible]
without [illegible]
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of the tu [illegible]
for 10 ye [illegible]
adenoma of the thyroid gland.

Nodular goitre

Genesis and management

Physiological considerations.—TAYLOR (1956) discusses the physiological considerations in the genesis and management of nodular goitre. The fundamental secretory unit of the

women is probably
demand made on
dular, the nodules
finally replacing the entire substance of the gland. The mechanism by which iodine

are chiefly due to pressure. The great veins of the neck may be compressed and the trachea displaced laterally or posteriorly. Dyspnoea ensues but dysphagia is rare. Lateral or posterior displacements of the carotid vessels may occur and the sympathetic chain be involved A number of nodular goitres eventually become toxic. The incidence of malignancy is higher in endemic areas, the mortality rate in England and Switzerland being almost the same. Indications for surgery are pressure symptoms and malignancy. In young patients a solitary nodule with lymph nodes in the neck suggests a papillary carcinoma. In older patients, a sudden enlargement of the gland, pain, paralysis of the recurrent laryngeal nerve and metastases are diagnostic features. Post-operative treatment by sodium-thyroxine or desiccated thyroid for 1–5 years or longer is usually essential.

Nature and treatment in children

HAYLES and his colleagues (1956) report on the findings in a series of 130 children
luded 68 cases of
with lymphocytic
congenital goitre
08–19 carcinoma
to be present in
70 per cent of cases. In contrast to adenomatous goitre, thyroiditis and carcinoma of the thyroid gland have occurred much more frequently during recent years. Surgical treatment is recommended for adenomatous goitre because it is impossible to distinguish the condition from carcinoma unless histological examination is employed. The most common histological pattern in adenomatous goitre is that of microfollicular and macrofollicular adenoma. *Usually some degree of papillary hyperplasia is also present.* A less common pattern is presented by foetal adenoma with a predominance of miniature foetal acini. Lymphocytic thyroiditis, or Hashimoto's disease, is an unusual cause of goitre in children. The goitre is large, firm and easily outlined. Treatment is by subtotal thyroidectomy. Radiotherapy is contra-indicated because its use may give rise to carcinomatous changes The common type of carcinoma of the thyroid gland of children

genital goitre.

Indications for treatment

PERLMUTTER and SLATER (1956) discuss the reasons for removing nodular goitres. Opinion about this has been much swayed by varying estimates of the possibility of

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... in these persons and also

...hey also ask if one can dis-

...ation. In a random group

...itre to lie between 3·5 and

8 per cent. In a number of autopsies in unselected persons nodular goitres had a frequency of between 7 and 12 per cent, but the writers conclude that existing figures do not permit the frequency of cancer in nodular goitre of unselected persons to be estimated They consider

are multi

tion if nc

to develop without any previous knowledge of a goitre and as goitre nodules are so common their prophylactic removal would be impossible as a routine, the number of persons affected in the United States of America being about a million. It is found that cancerous tissue retains little radio-iodine, though normal thyroid tissue does, and

uninodular goitres and have little experience of their diagnostic procedure with multinodular ones

Recurrent goitre

Management

Recurrent goitre is discussed by PIERCY and LANGE (1957) In 4½ years 3,500 new patients were seen in a thyroid clinic and department of endocrinology. Of these 306 had had previous examinations for goitre or thyrotoxicosis, but only 118 were found to have true recurrence of their disorder. Most of them were subjects of anxiety states, including women at the climacteric. Some were hypothyroid, with the remains of the thyroid gland excessively stimulated to do more than lay within its powers. In such cases giving thyroid was always followed by improvement, with shrinkage of the residual gland tissue. Some patients were seen because of recurrent laryngeal nerve palsy and 2 patients had per-

is useless, but if the trachea was bared previously the recurrence may be approached through the deep fascia in front of the *anterior border of the sternomastoid.* An absolute knowledge of the local anatomy is essential. It appears that subsequent operations are often needed because the whole gland was not exposed the first time. Ligation of the inferior thyroid arteries helps much in preventing recurrence. With diffuse goitres about 1–4 grammes of the posterolateral margin is left each side. With nodular goitres the quality of the remnants is the governing factor. Reconstitution of the remnants is necessary.

Mediastinal goitre

Origin by descent from the neck

Surgical approach.—After reviewing the literature JOHNSTON and TWENTE (1956) [illegible] They consider movement of a mediastinal tumour with swallowing as almost pathogno- [illegible] mining the position of the recurrent laryngeal nerve, the difficulty of ligating the inferior [illegible] small adenomas within [illegible] upward retraction. On one oc[illegible] they felt that [illegible] there is [illegible] they recom- [illegible] those in the [illegible] tal cartilages [illegible] ntrathoracic goitre they recommend commencing with the cervical approach and proceeding to anterior thoracotomy only if technical difficulties prevent delivery of the intrathoracic goitre. This should be necessary in only 5–10 per cent of cases.

Squamous-cell cysts of thyroid gland

Origin of cells

GOLDBERG and HARVEY (1956) discuss squamous-cell cysts of the thyroid and make observations on the *origin* of these cells in the human gland. At autopsy, without any known disease of the thyroid having occurred, small groups of squamous cells have sometimes been found in the gland, either alone or associated with some other morbid change in it and undetected in life. The authors describe a patient, aged 45 years, who [illegible]

are epidermoid cysts, lined only with squamous epithelium, without hair follicles or sweat glands. Theories to account for such epithelium in the thyroid postulate either a meta-

cyst of such origin, its position and appearance strongly supporting this suggestion.

Thyrotoxicosis

Diagnosis and treatment

Physiological concepts.—DOBYNS (1956) reviews the physiological concepts in the diagnosis and treatment of Graves' disease. The classical, clinical picture comprises hyperthyroidism, unique ocular manifestations and goitre, anyone of which may arise

primarily on some structure other than the gland, in which the change is secondary. The important role of the lymphocytes has been demonstrated at autopsy and at operation. In Graves' disease, the conversion of iodide into thyroxine and its release into the circulation is abnormally rapid, excess of the hormone may therefore explain the increased

essential Exophthalmos, rather than contra-indicating thyroidectomy, is often improved by the surgical correction of hyperthyroidism.

Antithyroid drugs

Carbimazole.—GREENE and MORGAN (1956) discuss the toxicity of the antithyroid drug carbimazole, and compare it with methylthiouracil In 261 cases treated with the latter drug, untoward effects occurred in 4 6 per cent and included skin reactions, severe nausea and sore throat. One death occurred from agranulocytosis. In this study, 181

are reported. Results show that the dangers of antithyroid drugs lie in their action upon the bone marrow, causing agranulocytosis, pancytopenia and a pure red cell anaemia. In a recorded case of each of the last two, neither can be directly attributed to the drug, although the coincidence in time is suggestive. In this series, however, carbimazole caused serious side-effects in only 1·1 per cent of patients, compared with 2·3 per cent treated

caused the pre-operative recurrence of thyrotoxicosis. Continuation of the drug, however, is advocated in every case until 7–10 days before operation, despite the consequent overlapping with iodine treatment.

Management

thyrotrophic activity of the pituitary seems probable, yet in some cases, as with toxic adenoma, the thyroid may be the primary site of abnormality. It is clear that when a goitre is already present there is a greater likelihood of toxic change developing. A transient auricular fibrillation after operation for simple goitre lends support to this view, but if a symptomless nodular goitre is found it is not now considered imperative to operate, though later malignancy is always possible, albeit rare. At first the antithyroid drugs were often used unwisely, but their value is great in making the post-operative stage safer by much reducing the chance of thyroid crisis, yet iodine before the intervention will often be sufficient. When these drugs are used alone the relapse rate is high and after such a procedure the surgeon may have to contend with increased difficulty. It is also too early to state if they may not in time exhibit carcinogenic effects. When they are

sedation are the first procedures indicated, other drugs being kept in reserve. Differentiation from an anxiety state may be difficult. There is no sign of classical thyrotoxicosis which may not be absent. In pregnancy, when the disorder develops, small doses of antithyroid drugs usually suffice. If exophthalmos is so marked as to threaten vision thyroid extract together with an antithyroid preparation may be needed, perhaps associated with surgery. At times operation on the skull cannot be avoided. Thyrocardiac cases need special consideration and usually surgical intervention is desirable, though the

[illegible] usual after operation; in bad risk cases anti-

[illegible]

operation requires much skill and attention as also the management during the stage after it. Some patients are resistant to antithyroid remedies, which should be evident [illegible] useless to continue longer. Estima-

[illegible] also needs correction. In general about

[illegible]

Management in children

McClintock, Frawley and Holden (1956) give an account of 50 cases of hyper- [illegible] to-male sex ratio was 24: 1

[illegible]

preliminary treatment The operation of choice [illegible] roidectomy. In 41 cases hyperplasia was detect[illegible] thyroid gland Colloid goitre was encountered in [illegible] adenoma in any case belonging to the series. One child died from pneumonia, but the [illegible]

[illegible]

longed hyperthyroidism exerts a deleterious effect in children it is emphasized that an [illegible]

should be maintained for 12–18 months.

Treatment with radio-iodine

[illegible]

First, dosimetry must be exact and second, account must be taken of the degree of sensitivity of the thyroid gland and the more or less homogeneous distribution of radio-iodine in this organ The authors describe a new technique for determining the volume and consequently the mass of the thyroid gland The capsule of the gland is almost completely surrounded by lax cellular tissue which lends itself well to the diffusion and

absorption of a gas injected into the infrahyoid region. About 150 millilitres of oxygen are required and insufflation should be carried out at a pressure of less than 5 centimetres of mercury. Immediately after insufflation radiographs are taken in the two perpendicular planes and also, if necessary, tomographs. The thyroid is easily visible, contrasted by the gas surrounding its capsule. The procedure has been carried out by the authors in 60 patients with complete safety. The reabsorption of emphysema takes place in a few hours and can be accelerated with local heat. Mediastinal emphysema did not occur. Calculation of the thyroid mass can be obtained either by evaluation of parallel sections of the area with a planimeter, reconstruction of the volume of the gland by superimposition of the sections representing the tomographic pictures, filling the space between them with plastic material or utilizing the formula that gives the volume of a scalene ellipsoid ($4/3\pi \times A \times B \times C$, where A, B, C, represent the semi-axes) The authors used all these methods comparing them with direct observation in those cases operated upon subsequently. All methods gave equally comparable results with an observed error of 10 per cent in any case. On account of its extreme simplicity they recommend the use of the formula of a scalene ellipsoid Using this method of pneumothyroid over a period of 2 years they achieved 70 per cent success after a therapeutic dose in 60 patients treated. The mass of the thyroid gland varied from 10 to 198 grammes.

Surgery of the thyroid gland

Mortality rate and causes of death

BEAHRS, RYAN and WHITE (1956) review the mortality rate and causes of death among patients undergoing surgical treatment of disease of the thyroid gland. During the course of a period of 16 years, 14,374 thyroidectomies were performed and 46 patients died whilst in hospital. After the year 1946 it was found that the death rate had diminished. This change was attributed to more careful selection of cases for surgical treatment and also to the fact that antibiotic agents had become available. Among the cases seen prior to the year 1946 there were 37 fatalities after 5,402 thyroidectomies and the mortality rate was 0·7 per cent. Corresponding figures for the subsequent series were as follows: 9 fatalities, 8,972 surgical procedures and a mortality rate of 0·1 per cent. The largest number of deaths occurred in patients suffering from adenomatous goitre and hyperthyroidism. Complications of surgical treatment included paralysis of the vocal cord (1·3 per cent of cases) and tetany (0·2 per cent of cases). The larynx was examined on several occasions in each case. It was expected that normal function would return in 26 of 35 patients with temporary paralysis or impaired function of the vocal cords. Myxoedema developed in at least 30 per cent of the number of patients with thyroiditis. Fifteen tracheotomies were performed either prophylactically or as emergency procedures for relieving inadequacy of the airway. Secondary haemorrhage developed in 2 cases and auricular fibrillation necessitated active treatment in 5 cases. Cardiac arrest occurred in a female patient on the completion of thyroidectomy, but the patient made a full recovery after cardiac massage. The authors point out that in routine thyroidectomy every care must be taken to protect the parathyroid glands. To this end, the surgeon is advised to preserve a rim of the posterior capsule of each lobe of the thyroid gland.

Thyroid gland auto-implants in rats

Survival time and reaction to methylthiouracil

DONIACH and LOGOTHETOPOULOS (1956) discuss the survival time and reaction to methylthiouracil of thyroid auto-implants in rats. They used 63 animals and in 45 the implants were recovered after 16 months, the time these survived. A month after hemithyroidectomy and implantation of one lobe the residual gland in the neck takes up about 7 times more of a tracer element than the implant but it does not seem that the latter will wither away; it is responsive to changes in the level of circulating pituitary thyrotrophic hormone and the initial regenerative growth is not abolished by thyroxin and this seems to be independent of the thyrotrophic hormone (T.S.H.) In the animals used in their present experiment the authors found a higher recovery rate in females and in

... too small to have much

Thyroid tumours

Aetiology and management

Physiological considerations.—Certain physiological considerations in the management and the aetiology of thyroid tumours are discussed by SONENBERG (1956) As spon-

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Thyroid cancer

Clinico-pathological study

ALHADEFF, SCOTT and TAYLOR (1956) present a clinico-pathological study of thyroid carcinoma While the incidence was highest in the group aged 60–70 years, nearly a quarter occurred in patients aged under 40 years. Over 40 years, the ratio of women to men was 4 1. Histologically, the tumours were follicular, anaplastic and papillary, in order of frequency. Papillary tumours predominated in cases aged under 30 years, follicular tumours between ages 30 and 40 years, while in the fifth decade the tumours were evenly distributed. Of 67 patients, 20 had had a previous goitre for an average of 17 years. The most common initial symptom was swelling of the neck, 9 of 24 patients complained initially of symptoms referable to distant metastases, the remainder of mild pressure

soft on palpation, nearly a third had evidence of local spread; and half presented with regional lymph node involvement and distant metastases. Papillary carcinoma generally did not give rise to pressure symptoms. The commonest lesion was a solitary nodule. Involvement of regional lymph nodes and fixation of the primary growth occurred in 50 per cent of cases; distant metastases occurred in 3 of 14 patients. Anaplastic carcinomas were hard, fixed, bulky and usually associated with recent and severe pressure symptoms. One-third presented with unilateral vocal cord paralysis, one-third complained of pain behind the ear, referred to the area of distribution of the lesser occipital nerve. Regional and distant metastases were already present in 50 per cent of cases. Analysis showed that follicular tumours metastasized twice as frequently to the skeleton, anaplastic twice as frequently to the lungs, while papillary growths did not give rise to bone deposits. Hyperthyroidism, rare in thyroid cancer, occurred in 4 cases. Iodine uptake, although commonly found in follicular carcinoma, was occasionally encountered in other types. Pathologically, the tumours were classified as differentiated and undifferentiated, the former including grade I and grade II follicular carcinoma and grade I and grade II papillary carcinoma; the latter, small-cell and giant-cell carcinoma. Miscellaneous tumours included two squamous-cell and one non-encapsulated sclerosing tumour. In its early stages cancer could not be distinguished clinically from a benign lesion; when it became more advanced it spread to the trachea, oesophagus and neck muscles, and nerve involvement was diagnostic. Carcinomatous fixity of the gland is differentiated from inflammatory fixation by the presence of metastases. In 63 per cent of cases a correct pre-operative diagnosis was made, in a third, however, it was only revealed at operation or pathological examination.

Hürthle-cell tumours of the thyroid gland

Pathology and clinical picture.—COLLINS (1956) presents a study of Hürthle-cell tumours of the thyroid gland. The history of the Hürthle-cell is reviewed from its discovery by Baber in 1877. Recent investigators believe it to be merely an expression of physiological change and cellular involution in thyroid epithelium resulting from thyrotoxicosis or inflammation. In 1948 Willis suggested the substitution of the term "eosinophilic large celled tumours of the thyroid" for Hürthle-cell tumours, stating that there was no definite evidence that the latter growth was related to Hürthle cells. The Hürthle-cell reaction is specific and characteristic. The cells are large, acidophilic or oxyphilic. They may be giant eosinophilic cells with abundant cytoplasm, clear, finely granular, opaque or foamy. They are cuboidal, polyhedral or cylindrical and may exhibit marked pleomorphism with eccentrically placed vesicular nuclei. They may be arranged in various patterns, mostly alveolar. Vein invasion is not diagnostic of metastasis. The Hürthle-cell reaction may be seen in various thyroid conditions from a normal gland to Hashimoto's disease; it offers a favourable prognosis. Hürthle-cell carcinomas are commonly encapsulated and often mimic benign adenomas. In late cases, the trachea, larynx and surrounding structures are often involved. On section, the tumour is greyish-yellow to tan and of low malignancy. In thyroid carcinoma, the Hürthle-cell change may mask the identity of original tumour on which the ultimate degree of malignancy probably depends. Distant metastases are rare. Recent authors believe the tumour to be a benign adenoma, since the usual criteria of malignancy are commonly absent. Collected clinical data show women aged over 40 years to be chiefly affected, the right lobe to be more often involved; and the history to be one of a long-standing goitre or solitary nodule. Metastasis is slow and a simple lobectomy, with removal of the isthmus on the affected side, usually effects cure. Nine new cases are reported, all women with an average age of 43 years and an average duration of goitre of 7–8 years. Eight cases were definite Hürthle-cell tumours, 2 being carcinomas. The ninth case demonstrated Hashimoto's disease with a diffuse Hürthle-cell reaction, rather than a circumscribed tumour. The behaviour of the Hürthle-cell tumour offers a striking contrast to that of Langham's tumour which is of high malignancy and metastasizes early.

Experimental induction, surgical treatment and radiotherapy

A discussion, in 1956, on carcinoma of the thyroid was opened by I. DONIACH by

operable While anaplastic cancers rarely responded to radio-iodine therapy, differentiated ones frequently did so. Radio-iodine uptake rarely occurred in the tumours while normal thyroid tissue remained in the body. Total thyroidectomy and excision of any large tumour masses is recommended before treatment is commenced. Thyroxine should be given after myxoedema develops except during the 4 weeks before each dose of radio-iodine. While treatment can be continued for several years in most patients, the presence of bone metastases may result in aplastic anaemia if treatment continues for more than a year.

Papillary tumours

Importance of radical surgery.—RUNDLE and BASSER (1956) stress the importance of radical surgery in cases of papillary thyroid cancer. Papillary cancer spreads by direct invasion and by the lymphatic vessels, in contrast to the follicular type which invades

and cervical vertebrae and nerve roots. The ideal plan of surgical treatment is discussed. It is suggested that all suspicious nodules should be excised and immediately examined as frozen sections. Should the pathology be confirmed a total extrafascial thyroidectomy

should be performed together with excision of the juxtathyroid lymph nodes. Should slower methods, such as paraffin section, be employed, even if a second operation is possible in 24–48 hours, before post-operative inflammation makes surgery difficult, the hazard to the patient will be much increased. The examination of a frozen section also avoids the danger of radical surgery, where local excision would have been adequate. Because of its disadvantages routine post-operative radiotherapy should be avoided.

Carcinoma of the thyroid gland in children

Pathology and treatment

MAJARAKIS, SLAUGHTER and COLE (1956) report on 15 cases of carcinoma of the thyroid gland in patients aged 5–20 years. The patients were under observation at the University of Illinois Research and Educational Hospitals during the period 1936–56. The series comprised 9 females and 6 males. Analysis of the data showed that the average duration of the mass in the neck was 4·3 years. Pathological reports revealed 7 cases of papillary adenocarcinoma, 5 cases of adenocarcinoma and 3 cases of adenocarcinoma in adenoma, or adenoma malignum. There was an incidence of 31·1 per cent for carcinoma arising from non-toxic nodular goitre. Seven patients had metastases in the cervical lymphatic nodes, and in these cases the diagnosis was made prior to surgical intervention. Intensive irradiation was employed in 4 of 5 cases diagnosed post-operatively, and apparently the patients treated in this manner remained free from carcinoma. Ten patients aged 15 years or less, had radiotherapy applied to the head and neck. The total dose of irradiation ranged from 200r to 625r. Nine thyroidectomies were performed in conjunction with radical neck dissection. All the patients in the series survived, but residual disease was detected in 22·2 per cent of cases. Subsequent to surgical treatment some patients received as much as 4 grains of desiccated thyroid gland daily. Having regard to their findings, the authors recommend complete removal of the thyroid gland on the affected side in cases of non-toxic nodular goitre, provided that the gland tissue on the opposite side is normal.

Study of case histories

WINSHIP (1956) studied the case histories of 334 children suffering from thyroid cancer. They were collected by reviewing the world literature, sending questionnaires to all children's hospitals in the United States of America and Canada and visiting centres in western Europe during 1951. All cases were diagnosed before the age of 15 years. Photomicrographs were obtained on proved metastases. Where slides were not available, only the confirmation of pathologists skilled in the diagnosis was accepted. Aetiology is discussed. It was found that more cases occur in non-goitrous than in goitrous regions. The cases are concentrated where medical interest is high. No connection appears to exist between the enlargement during cobalt therapy or the hyperplasia on a soya bean diet and cancer. Twenty per cent of cases gave a history of irradiation to the thyroid gland in infancy. Statistics show that 27 per cent of thyroid nodules in children are carcinomatous; the most common presenting sign is a painless nodule. Fifteen per cent of cases had pulmonary metastases and 8 patients had osseous ones when first seen. The average duration of symptoms before diagnosis is nearly 2 years. Painless swelling in the gland is frequently disregarded. Treatment is varied and this series does not prove one method to be better than another. Ninety-four per cent had mainly surgical treatment, the remainder having irradiation following biopsy. In 31 per cent of the first group a second operation was performed within 1 week to 26 years, either because the first diagnos[illegible] because of recurrence. It is observed that all nodul[illegible] frozen sections examined. All pathological type[illegible] iodine in therapeutic doses was given to 20 per ce[illegible] external irradiation was used in a few cases. Sufficient follow-up data is available in 226 cases. Seventeen per cent of all known cases have died at periods from shortly after operation to 23 years; the percentage dying from each pathological type is in the same proportions as its occurrence. Deaths occurred mostly when diagnosis was long delayed. Of 45 patients followed-up for over 10 years, 17 had evidence of disease, one of them for as long as 27 years; 24 were without signs of recurrence. Because of its long course thyroid cancer should be observed for at least 20 years.

Metastatic carcinoma of the thyroid

Management with radioactive iodine

normal thyroid tissue, the latter must be eliminated before ^{131}I therapy commences Large and prolonged doses of antithyroid drugs such as thiouracil should be administered to enhance the concentration of iodine in the tumour. The authors calculate the dose of ^{131}I partly on the total retention of the tracer dose and partly on the estimated volume of all tumour tissue present Their therapeutic doses usually ranged from 100 to 200 milli-

antithyroid drug, three doses of ^{131}I resulted in regression of the metastases in the skull and pelvis. She remained well 2½ years later. Case 4· a white female, aged 60 years, showed a rare complication of metastatic carcinoma, hyperthyroidism due to hyperfunctioning metastases She died suddenly due to obstruction by large pedunculated metastasis within the trachea.

Exophthalmos

Report of case with persistent lactation

JACKSON (1956) describes a case of persistent lactation in a married white woman,

the level of serum phosphorus and an increase in urinary calcium; the serum calcium and urinary phosphorus were unaltered. The author suggests that the pituitary is implicated with a tendency to turn out an excess of thyrotrophin, prolactin and exophthalmos-producing hormone

A method of orbital decompression

ROWBOTHAM and CLARKE (1956) describe a method of orbital decompression to relieve progressive exophthalmos. Thirty cases were thus treated, in 15 of which the disease was unrelated to any other condition and in the remainder it was associated with thyrotoxicosis. In some of the second group thyroidectomy or treatment with thiouracil or radioactive iodine had preceded the surgical intervention. All patients complained of pain in the orbit and in every case there was some degree of ophthalmoplegia. Tarsorrhaphy was

[illegible]

excess of orbital fat. In 5 patients pieces of lacrimal gland were removed and showed chronic infl[illegible] that the orb[illegible] replaced by [illegible]
It is usually thought that overaction of the anterior pituitary is responsible, and the medical treatment of this is designed to reduce the secretion of thyrotrophic hormone. The operation described is simple, fulfils cosmetic considerations and is effective.

Adrenalectomy

Hormone replacement therapy

[illegible] replacement therapy since the first [illegible] management of pati[illegible] impler to treat patients [illegible] the pituitary [illegible] l patient, or the mas[illegible] patient with the adrenals suppressed by cortisone therapy, is a sudden major stress [illegible] within [illegible] rapidly [illegible] ty. The [illegible] al who underwent adrenalectomy for metastatic malignant disease, of whom [illegible] ved for 5 months or more. Pre-operatively, 100 milligrams of cortisone acetate was given intravenously, 48, 24 and 1 hour before operation, while 50–100 milligrams were given at the end of the operation and again later that night. Subsequently the oral dosage was scaled [illegible] daily. Full

[illegible]

table of 9-α-fluorohydrocortisone and prednisolone.

Intracranial metastases from breast cancer

The treatment of intracranial metastases from breast cancer by adrenalectomy is discussed by CLAIN and HUNT (1956) Although, as they point out, bilateral gonadectomy and bilateral adrenalectomy often give good results with secondaries of this type, the

fossa, and the left lung also showed metastases She was first given testosterone propionate, then cortisone, and the diabetes insipidus was treated by pitressin. Both adrenals were then removed and recovery, though slow, was steady. Two years later the skull x-rays were normal. In another patient typical attacks of grand mal developed in a woman aged 43 years who had had operative and x-ray treatment for breast cancer 3 years before. Extensive secondaries were seen in the lungs and testosterone propyl propionate was

Adrenalectomy and hypophysectomy in advanced breast cancer

Comparative study

ATKINS and his colleagues (1957) present a comparative study of adrenalectomy and hypophysectomy for advanced breast cancer. Treatment of this lesion by modifying the endocrine environment originated in 1896 when Beatson, by removing the ovaries in 2 patients, obtained remission Lett (1905) reported further cases and oophorectomy was practised sporadically for many years, with only temporary improvement in some patients. An explanation seemed to lie in the secretions of oestrogens by adrenal tissue, which would be unaffected by removal of the ovaries. Adrenalectomy was first performed by Atkins in 1947, the object being to remove as much oestrogen-secreting tissue as possible, but until cortisone became available, the total operation was impossible. Henceforward,

divided between the two operations. The pre-operative, operative and post-operative techniques of both are described Patients subjected to these operations require carefully supervised maintenance therapy, including monthly visits to the hospital for examination. In hypophysectomy cases, the serum-cholesterol level is estimated periodically to assess thyroid function; electrolyte studies are made for suspected adrenal deficiency. Therapeutic measures in both cases include cortisone, deoxycortone acetate and sodium chloride. The first, in 25 milligram oral doses twice daily, is a safeguard against stress and infection, the necessity for increased dosage is an ominous prognostic sign. Deoxycortone acetate counteracts hypertension and sodium depletion. Sodium chloride is given, if necessary. Special maintenance therapy after hypophysectomy may include control of epilepsy, diabetes insipidus and myxoedema. Acute infection or accident calls for substantial increase in the adrenal steroids, which the patient herself cannot provide; increased dosage of cortisone to about 150 milligrams is therefore essential. Some degree of diabetes

insipidus developed in all cases, but progressively declined. The patients who underwent hypophysectomy survived, in the average, 4 months longer than those subjected to adrenalectomy; during the follow-up period, moreover, the adrenalectomy mortality rate climbed more steeply than the hypophysectomy rate. By calculating the mean clinical value the degree of benefit conferred was estimated. These findings suggest that if the ablation of endocrine tissue is indicated in advanced mammary cancer, hypophysectomy is preferable to adrenalectomy, although the results are not statistically significant.

Adrenal cortical insufficiency

Surgery and the chronically ill patient

HOWLAND and his colleagues (1956) draw attention to the increasing number of radical surgical procedures which are now performed on the chronically ill patient, and the greater incidence of adrenal cortical insufficiency during or immediately after operations due to the frequent administration of cortisone for various conditions. Reviewing the statistics for the previous year at the Memorial Center for Cancer and Allied Diseases, they found that 25 pa [illegible] form of adrenal cort [illegible] failure to respond to [illegible] and a prolonged reaction time after anaesthesia. The authors describe 7 cases in detail which confirm the work of previous investigators They found that adrenal cortical insufficiency during operation or immediately post-operatively could be treated success- [illegible] The authors' patients, 2 male and 5 female, [illegible] cortisone during the [illegible]

Adrenaline and nor-adrenaline

Plasma levels in varying conditions of stress

Plasma concentrations of adrenaline and nor-adrenaline were measured in various conditions by HAMMOND, ARONOW and MOORE (1956) They used a modification of the [illegible] n the last 15 years much progress [illegible] o estimate the hormones in the [illegible] ormed in the adrenals have been [illegible] therefore made a study of a few surgical patients [illegible] have [illegible] early [illegible] the patients chosen none was in shock and only a few [illegible] some "dummy" operations [illegible] were noted. Further work [illegible] hers who had been injured [illegible] ormal range of adrenaline-like material to be 0 5 microgra [illegible] than 0.1 microgram could not be measured by the techniq [illegible] hat a 3-hour ether anaesthesia caused a fall [illegible] increase in the blood 17-OH-CS to levels as [illegible] of this substance vary and may [illegible]

cause a fall in urinary sodium for some days and difficulty in excreting water. Other [illegible] have different effects. It did not seem that adrenaline and nor-adrenaline [illegible] vo patients with [illegible] if there are any [illegible] ngs. It is likely [illegible] may interfere with the method of analysis used. It was [illegible] may not have been ideal. Furthermore, both [illegible]

Hyperparathyroidism

CRAWFORD, STEFANELLI and ALVAREZ (1956) describe 3 unusual cases of hyperparathyroidism. They think the condition is more common than is suspected. In one patient they observed, a limp developing when aged 3 years was attributed to a simple bone cyst [illegible] and filled with bone ch [illegible] excretion of calcium was found. Operation was per- [illegible] adenoma of the gland was removed. Three years later, though the fractures [illegible]

striking. It was only then that the relationship between peptic ulcer and hyperparathyroidism was remembered The ulcer had healed 4 weeks after the neck operation. In the third patient, a woman aged 41 years, there was a long history of limb pains, [illegible]

Pituitary destruction in advanced cancer

Radon implants

FORREST and his colleagues (1956) describe the use of radon implants for advanced cancer. These are put through the nose to destroy the pituitary when the disease is out of control. The primary site was most often the breast and this form of therapy was used when lymph nodes, bones, the lungs and even the brain exhibited secondary deposits. Some of those treated had failed to respond to hormone therapy and one had had bilateral adrenalectomy without useful effect. In this patient the result of implantation in the pituitary was so good that removal of the adrenals seemed unnecessary. Hormonal studies in earlier cases had shown that the doses used were too small so much higher ones were used, the technique being a little modified also. No death from the treatment was recorded. Radiation damage to the optic tract is a definite hazard and in 4 of the 33 patients treated some such occurred. Evidence of hypopituitarism was seen a few weeks after the insertion of radon. It was usually necessary to give cortisone and if withheld for a few days typical withdrawal symptoms developed. In some cases the signs of myxoedema developed in a few months; one of the earliest hormonal effects was the appearance of diabetes insipidus, the severity of the polyuria depending on the dose of cortisone used. In the 8 cases of cancer not arising in the breast the treatment seemed useless and all died. Of the 25 cases of breast cancer 9 died and 9 others had no improvement while 7 were benefited. It is felt that if the pituitary could be more effectively destroyed, such destruction only being complete in 2 out of 7 cases examined at necropsy, better results are possible. A less penetrating isotope may also be more useful. By reason of the many anatomical variations loss of sight appears an unavoidable risk of the procedure

Myasthenia gravis associated with myopathy

Thymectomy

GRIFFIN, NATTRASS and PASK (1956) describe a case of thymectomy in a patient with myopathy and myasthenia gravis The operation was performed in a stage of respiratory failure. The patient, a male aged 35 years, had been well until the age of 14 years but he then began to experience difficulty in holding up his arms during physical training. The physician who saw him then diagnosed muscular dystrophy and prescribed glycine, which caused improvement for 6 years. He was able to work as a labourer. Weakness then increased and he gave up work; his condition was worse in cold weather. When seen by another physician he could walk with a rather marked lumbar lordosis but had to use his hands in climbing stairs and could only rise from the floor by pushing his knees with his hands. Many muscles were weak, tendon reflexes were present but sluggish. The legs were wasted and an electromyogram showed that he had a myopathy rather than a neuropathy. Muscle biopsy also supported this view. He was given α-tocopherol but this helped little and later, being given an ephedrine tablet by an asthmatic friend, he tried this and felt better. It was then formally prescribed thrice daily. Intramuscular neostigmine did not appreciably help him. Three years later he was worse and on arrival in hospital emphasized that he felt better after rest. Larger amounts of neostigmine and ephedrine caused little improvement and at a time when thymectomy was under consideration breathing suddenly stopped. Artificial respiration was begun and then an endotracheal tube was inserted and positive pressure, intermittently, was instituted to maintain breathing. In the weeks which followed many difficulties were overcome. Though after a time it seemed clear that the patient could breathe without instrumental aid he frequently called for the respirator, showing some loss of nerve. It was concluded that thymectomy was necessary and this was performed 36 days after breathing had originally stopped. Full respiratory power returned after a time and he was able to resume work, needing only to take ephedrine thrice daily. The case was considered to be one of atypical myasthenia gravis associated with myopathy.

REFERENCES

Aird, I., and Helman, P. (1955). "Bilateral Anterior Transabdominal Adrenalectomy." *Brit. med. J.*, 2, 708.

Alhadeff, R., Scott, F., and Taylor, S. (1956). *Brit. J. Surg.*, 43, 617.

Atkins, H. J. B., Falconer, M. A., Hayward, J. L., and MacLean, K. S. (1957). "Adrenalectomy and Hypophysectomy for Advanced Cancer of the Breast. A Comparative Study." *Lancet*, 1, 489.

Beahrs, O. H., Ryan, R. F., and White, R. A. (1956) *J. clin. Endocrin.*, 16, 1456.

Biorck, G., Axen, O., and Thorson, A. (1952). *Circulation*, 12, 1.

Buckwalter, J. A., Soper, R. T., Davies, J., and Mason, E. E. (1955). "Post-operative Hypoparathyroidism." *Surg Gynec. Obstet.*, 101, 657.

Burrell, C. D., Fraser, R , and Doniach, D. (1956) "The Low Toxicity of Carbimazole; survey of 1,046 patients." *Brit med J.*, 1, 1453.

Clain, A , and Hunt, A. H. (1956). *Brit. med. J.*, 2, 627.

Clark, D. E. (1955). "Association of Irradiation with Cancer of the Thyroid in Children and Adolescents." *J. Amer. med. Ass.*, 159, 1007.

Collins, D. C. (1956). *Arch. Surg , Chicago*, 73, 228.

Conn, J. W. (1955). "Primary Aldosteronism. A New Clinical Syndrome." *J. Lab clin. Med.*, 45, 6.

Cooke, R. T , and Luxton, R. W. (1955). *Lancet*, 1, 968.

— and Wilder, E. (1954). *Ibid* , 1, 984

Cope, O , and Raker, R. W. (1955). "Cushing's Disease, the Surgical Experience in the Care of 46 cases." *New Engl. J. Med.*, 253, 119.

[illegible]

16, 1380

Hendrick, J. W (1956) *Ann. Surg.*, 144, 176.

Howland, W. S , Schweizer, Olga, Boyan, C. P , and Dotto, Alma, C. (1956) *J. Amer. med. Ass.*, 160, 1271.

Jackson, W. P. U. (1956). *J. clin. Endocrin* , 16, 1245.

Johnson, N (1955) "The Blood-supply of the Human Thyroid Gland Under Normal and Abnormal Conditions." *Brit. J. Surg.*, 42, 387.

Johnston, J. H , and Twente, G. E (1956). *Ann Surg* , 143, 572.

McClintock, J. C., Frawley, T. F., and Holden, J. H. P. (1956). *J. clin. Endocrin.*, 16, 62.
Majarakis, J. D., Slaughter, D. P., and Cole, W. H. (1956). *J. clin. Endocrin.*, 16, 1487.
Morgans, M. E., and Trotter, W. R. (1954). "Treatment of Thyrotoxicosis with Potassium Perchlorate." *Lancet*, 1, 749.
— — (1957) "Defective Organic Binding of Iodine by the Thyroid in Hashimoto's Thyroiditis." *Ibid.*, 1, 553.
Perlmutter, M., and Slater, S. L. (1956). *New Engl. J. Med.*, 255, 65.
Piercy, J. E. (1956). *Proc. R. Soc. Med.*, 49, 174.
— and Lange, M. J. (1957). *Lancet*, 1, 177.
Pochin, E. E. (1956). *Proc. R. Soc. Med.*, 49, 176.
— (1957) "The Place of Radioactive Iodine in the Treatment of Thyroid Disease." *Post Grad. med. J.*, 33, 317.
Radley-Smith, E. J. (1957). *Proc. R. Soc. Med.*, 50, 866.
Riddell, V. (1956) *Brit. J. Surg.*, 44, 25
Roitt, I. M., Doniach, Deborah, Campbell, P. N., and Hudson, R. V. (1956). "Auto-antibodies in Hashimoto's Disease (Lymphadenoid Goitre)." *Lancet*, 2, 820.
Ross, J. P. (1956) *J.R. Coll. Surg., Edinb.*, 2, 81.
Rowbotham, G. F., and Clarke, P. R. R. (1956). *Lancet*, 1, 403.
Rundle, F. F., and Basser, A. G. (1956). *Cancer, N.Y.*, 9, 692.
Sholl, P. R., and Black, B. M. (1954). "Superior Vena Caval Syndrome Resulting from Lymphocytic Thyroiditis." *Proc. Mayo Clin.*, 29, 259.
Simpson, C. L., Hemelmann, L. H., and Fuller, L. M. (1955). "Neoplasm in Children Treated with X-rays in Infancy for Thymic Enlargement." *Radiology*, 64, 840
Sonenberg, M. (1956). *Amer. J. Med.*, 20, 710.
Statist. Bull. Metrop. Life Insce. Co., 37, 8.
Storaasli, J. P., and King, D. P. (1956). *Amer. J. Roentgenol.*, 75, 1150.
Taylor, S. (1953). "The Evolution of Nodular Goiter." *J. Clin. Endocrin.*, 13, 1232.
— (1956). "Physiologic Considerations in the Genesis and Management of Nodular Goiter." *Amer. J. Med.*, 20, 698.
Thomson, A. D. (1955). "The Thymic Origin of Hodgkin's Disease." *Brit. J. Cancer*, 9, 37.
Winship, T. (1956). *Pediatrics, Springfield*, 18, 459
Witebsky, E., Rose, N. R., and Shulman, S. (1955) "Studies in Organ Specificity 1. The Serological Specificity of Thyroid Extracts." *J. Immunol.*, 75, 269.
Wynder, E. L. (1952). "Some Practical Aspects of Cancer Prevention." *New Engl. J. Med.*, 246, 573
Wyngaarden, J. B., Wright, B., and Ways, P. (1952). "The Effect of Certain Anions upon the Accumulation and Retention of Iodide by the Thyroid Gland." *Endocrinology*, 50, 537.
Zondek, H., and Leszynsky, H. (1956). *Lancet*, 1, 77.

ORTHOPAEDIC AND FRACTURE SURGERY

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FRACTURE SURGERY

Fracture of the femoral neck

The "adduction" type of fracture of the femoral neck has for long been recognized as presenting special difficulties in treatment The majority of the patients sustaining this fracture are of advanced age and are often suffering from other conditions, such as cardiac disease, making them bad surgical risks The immediate problem is often one of saving life by the avoidance of pulmonary, cardiac and urinary complications. Even if these difficulties can be surmounted and an adequate fixation of the fracture carried out, the long-term results are poor, necrosis of the femoral head with its sequelae of non-union or arthritis occurring in from 30 to 50 per cent of all cases

Methods of fixation

The value of internal fixation of the fracture as a life-saving measure has been appreciated for many years. However, early attempts at fixation failed because of toxic and electrolytic reactions to the metals then available The reintroduction by Smith-Petersen (Smith-Petersen, Cave and Van Gorder, 1931) of a flanged nail made from stainless steel marked a definite advance. Soon afterwards the introduction by Johansson (1932) of the cannulated nail led the way to the modern technique of "blind" nailing of the fracture. This operation and its subsequent development by Watson-Jones (1936) was a clear improvement on the original method, as being a less formidable procedure than the introduction of the nail under direct vision by open operation on the fracture itself. However, it soon became apparent that the failure rate was still high even after adequate fixation. In the search for improved methods of fixation and for avoidance of further damage to the vessels of the head many techniques were evolved, notably the lag screw methods of Godoy Moreira and others and the methods of fixation by three or four slim nails Even with these methods the results were still poor, and in recent years some surgeons have become

so discouraged by them as to advocate prosthetic replacement of the femoral head as a method of primary treatment. This radical method has not been generally accepted because of the undoubted facts that at least 50 per cent of all cases do well with nailing and that the results of these successful cases are definitely superior to those of prosthetic replacement.

Avascular necrosis

It is generally accepted that the majority of the failures of nailing are due to damage to the blood supply of the head fragment. The ever-present difficulty has been to decide at the time of primary treatment which of the cases are likely to develop avascular necrosis. If this decision could be made early, then only those patients with assured vascularity of the femoral head would be subjected to nailing. In the others, alternative procedures such as prosthetic replacement or osteotomy could be used. Under those circumstances the failures of nailing would be restricted to those caused by faulty placing of the nail—usually an avoidable occurrence—and those caused by other factors such as sepsis, interposition of soft tissues, difficulty of reduction or intercurrent disease. It is unfortunately very difficult or even impossible to make an early decision on clinical and radiological grounds as to whether the head fragment has been partly or totally deprived of its blood supply. Avascular necrosis may become evident by early slipping of the nail, by increased density of the head, by resorption of the distal part of the head and slow "ploughing" of the nail, by delayed union of the fracture, by infraction of the upper part of the head or by the late onset of arthritis (Hulth, 1956). Except in occasional cases the appearance of any of these signs of avascular necrosis usually comes too late for the hip to be salvaged. In the attempt to make an early decision on the state of vascularity of the head, Tucker (1950) and Arden (Arden and Veall, 1953) have used the systemic injection of radioactive phosphorus, measuring the relative concentrations of this material in the head and in the trochanter. Apart from the possible fallacy in this method from diffusion of the radioactive material, the method itself requires an amount of special apparatus which is unlikely to be generally available. The simpler method of iliac arteriography has not proved uniformly satisfactory, on account of the difficulty of getting adequate visualization of the small but important foveolar and synovial arteries.

Venography of the head fragment

More recent work, of great promise, has been concerned with the determination of vascularity by venography of the head fragment. In this connexion the work of Hulth (1956) is specially notable. Hulth has studied the vascular anatomy of the head and neck of the femur, following on the work of Trueta and Harrison (1953). He has described a technique for venography by which the head is injected with two millilitres of Umbradil at the time of operation, after reduction of the fracture. He describes "positive" and "negative" venographies. In the former, the veins which fill with contrast medium are those of the external and internal iliac systems. To the external iliac system belong the retinacular and intrinsic veins, the medial circumflex, femoral and external iliac vessels ("circumflex venographies") (Fig. 20). To the internal iliac system belong the foveolar vein (in the ligamentum teres), the acetabular, obturator and internal iliac vessels ("teres venographies") (Fig. 21).





FIG 21.—Positive venography (teres type) in adduction fracture of the femoral neck (Hulth, 1956).
(By courtesy of Dr A Hulth and the Editor of Acta chir scand)

In the latter ("negative" venographies) no filling of the veins occurs (Fig. 22). There is also an intermediate group of "uncertain" results in which no sharp distinction between positive and negative could be made. Hulth argues that since the arteries and veins run together on their way to the femoral head, a positive venography is good evidence that the corresponding arteries exist and are patent.



FIG. 22.—Negative venography in adduction fracture of the femoral neck (Hulth, 1956)
(By courtesy of Dr A Hulth and the Editor of Acta chir scand)

He has performed venography in the cadaver, and in the living subject has applied his method to trochanteric fractures, to both "adduction" and "abduction" types of fracture of the femoral neck and to some cases of upper femoral epiphyseolysis. Results are available from venography in 18 abduction fractures and in 82 adduction fractures of the neck of the femur. In the former group there were 14 positive, 2 negative and 2 uncertain results. In the latter group there were 66 positive, 15 negative and 17 uncertain results. In the abduction fractures circumflex venography was the more common finding, while in the adduction type teres venography was more usual. The follow-up of 45 cases of certain positive or negative venography was possible. All cases having negative venographies developed signs of avascular necrosis. In this connexion it is interesting to observe that the abduction fractures with an avascular head fragment healed normally. Hulth's explanation for this is that in these fractures there is good contact between the fracture surfaces, and also good stability, so that substitution can occur undisturbed. Of the cases showing a positive venography, about one-third developed avascular manifestations, but in none of these was there distal resorption of the head nor penetration of the nail. It is important to notice Hulth's confirmation of the fact that under favourable conditions even a totally necrotic head may unite without resorptive

phenomena The favourable conditions are, of course, more commonly present in abduction fractures, but may still occur in the adduction type.

Relation of results of venography to clinical factors. Hulth has also related the results of venography to the age of the patient, to the degree of displacement of the fracture, to the site of the fracture and to the nature of the fracture as determined by the fracture-shaft angle As regards age, he finds, as would be expected, that teres venography becomes more common in the older age groups. Displacement of the fracture seems to have little bearing on damage to the vessels. There appears to be no certain difference in residual vascularity between the subcapital and the transcervical fractures, and this finding confirms the impression of many surgeons that no definite prognostic inferences can be drawn from radiological findings alone. Again, the residual vascularity does not seem to bear any relation to the size of the fracture-shaft angle

Drawbacks of venography Hulth points out the drawbacks of this method. These are first, the production of a percentage of pictures which are difficult to interpret. Such pictures may be due to poor placement of the cannula, and it is hard to see how this difficulty may be overcome. Secondly, there is the possibility that the contrast material may damage the bone and its blood vessels. Such damage —if it occurs at all with the technique described—is likely to be purely local, and the evidence available suggests that this factor is not important.

Value of venography. Venography of the femoral head is undoubtedly a valuable method of assessing the likelihood of avascular necrosis It is a method requiring little in the way of special apparatus, and it is therefore suitable for general clinical use. The evidence is certainly that a negative venography means that nailing is likely to fail, and such a finding would certainly suggest the advisability of using some other method of primary treatment. On the other hand, the incidence of avascular necrosis in the cases of positive venography means that this finding cannot be accepted without reserve as an indication of a good prognosis. Again, the apparently inevitable finding of a proportion of uncertain results means that the technique cannot be accepted as being absolutely reliable. It is likely that further development of the method will be possible the substitution of a radioactive salt for the contrast medium, though requiring more specialized apparatus, could remove the possible hazard of local damage and the possible fallacy introduced by the mechanical disturbance of injecting a relatively large amount of fluid.

Elimination of mechanical causes of failure

Charnley, Blockey and Purser (1957) have approached the problem of the fractured femoral neck from another angle Starting from the premise that non-union can occur in the presence of a viable head, Charnley has studied the progress of cases in which fixation which is nearly perfect both by mechanical and biological standards has been applied. His object has been to eliminate mechanical causes of failure and so to obtain an accurate assessment of the number of cases in which avascular necrosis has been present and has either caused or could have caused, non-union. Charnley's method, briefly, is that a screw, coarse-threaded on its inner end, is introduced into the head of the femur; the outer end of the screw, which is fine-threaded, has a sliding fit into a "sleeve plate" which is secured by screws to the outer cortex of the femoral shaft. A spring-loaded cylindrical nut

holds the two parts of the apparatus together (Fig. 23). The appliance thus gives exceptionally rigid fixation, allows for absorption of the neck and head without loss of rigidity and exerts a continuous compressing force on the fracture surfaces. This spring-loaded compression screw is undoubtedly a great advance on previous methods of fixation, removing as it does both the mechanical imperfections of earlier methods and allowing for shortening of the neck without loss of efficiency. The value of the continuous compression may be twofold: it will certainly guard against rotational strains by increasing the friction grip at the fracture line, and it may, as Charnley's earlier work suggests (Charnley, 1953) be a direct causative factor in promoting union.

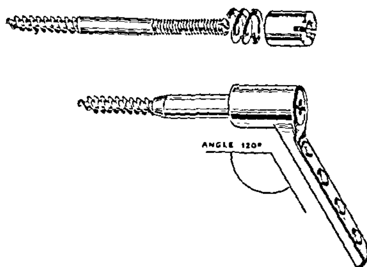


FIG. 23.—Compression screw for fractures of the femoral neck (Charnley, Blockey and Purser, 1957).
(By courtesy of Mr J. Charnley and the Editor of J. Bone Jt Surg.)

Clinical material

The material available for study consists of 33 cases of displaced fracture of the femoral neck whose progress has been followed-up for over a year from operation. Of these, 27 were "clinical successes" and 6 were failures. Of these latter, 3 were due to cutting-out of the screw, 1 to breakage of the screw and 2 to complete collapse of the head from necrosis. Of the clinical successes, 11 showed undoubted evidence of perfect osseous union (Fig. 24). Seven cases showed marked collapse with extrusion of the screw, and the evidence in these suggested that avascular necrosis with only partial osseous union had taken place (Fig. 25). The excellent fixation had prevented complete mechanical failure. Seven cases occupied an intermediate group between these extremes, and in these the evidence suggested some degree of avascularity with late osseous union. Charnley presents convincing evidence that the continuous compression is not harmful to the circulation of the femoral head.

Conclusions

three important con-
ndoubtedly eliminates
degree of circulatory
placed fracture of the
femoral neck. Thirdly, good fixation can prevent complete mechanical failure in a proportion of cases complicated by avascular necrosis. While the question of the value of continuous compression in promoting union remains open, it seems



certain that surgeons will come to rely increasingly on some form of fixation of the Charnley type for the primary treatment of these fractures. Under ideal circumstances the plan of treatment would seem to be as follows: the fracture is reduced under radiographic control. Venography is performed, and if a positive or an uncertain result is found fixation on the Charnley principle is carried out. If there is a negative result from venography, prosthetic replacement is carried out, one of the stronger types of metallic prosthesis, such as that described by Moore (1957), being used. The undertaking of this rather more formidable procedure would, of course, be dependent on the general condition of the patient. Such a plan would avoid the fixation of a fracture in which the result was certain to be poor, and would avoid too the removal of a viable femoral head in a fracture of good prognosis. It would also give the best chance for a functional result in a case where the impairment of vascularity was not sufficient to preclude a successful result.



(a)



(b)



(c)

(d)



(e)



FIG. 25.—Illustrating progressive extrusion of the screw. No radiological evidence of ischaemia (Charnley, Blockley and Purser, 1957).

(By courtesy of Mr J. Charnley and the Editor of J. Bone Jt Surg.)

ORTHOPAEDIC SURGERY

Osteoarthritis of the hip

Relief of pain

In comparison with the vast amount of work that has been done on operative techniques for the relief of osteoarthritis of the hip, remarkably little has been done on the causation of pain in that condition. This is the more remarkable since one of the chief objects of treatment is the relief of pain, and it is this aim which treatment commonly fails to attain. In its common form the pain of an osteoarthritic hip is felt over the anterior aspect of the joint with radiation to the groin and is of aching character with sharp exacerbations. It may be felt at rest, but is chiefly experienced when the patient starts to move after having been at rest for some time. Under these circumstances the pain is initially severe but may wear off as activity is continued. In its more severe form the pain is almost continuous by day and by night, is exacerbated by movement and becomes progressively worse with walking. Over the course of years the severity of the pain reaches a maximum and then commonly declines, so that the patient is eventually left with a moderately stiff but almost painless joint. It is not very often that this evolution can be followed, since the severity of the pain at its worst usually compels the patient to undergo some form of operative treatment. It is, however, a striking fact that where a long waiting list for in-patient treatment has compelled patients to defer operation, many have become pain-free by the time that they are admitted. Quite often there seems to be a relation between the pain and external temperature, humidity and atmospheric pressure. Patients will frequently say that the pain is worse under conditions of cold or damp or before rain. It is uncommon for a patient to tell of relief by the adoption of any special posture of the hip. The severity of the pain bears little or no relation to the severity of the pathological changes as judged by radiography. Pain may be prominent before any radiological changes have developed and may be slight or even absent by the time that these changes are most severe.

Response of pain to empirical treatment. The response of the pain to certain rather empirical methods of treatment is very striking. Injection of hydrocortisone into or near the hip often succeeds in giving relief from pain for several days or even for several months. The simple procedure of trochanteric osteotomy often produces an instant relief of [illegible]
see a patient who has for yea [illegible]
following the operation. Sir [illegible]
simpler procedures of drilling of the femoral neck and of manipulation of the hip. Except, however, in the case of trochanteric osteotomy, relief of pain by these procedures is rarely long-lasting.

Origin of the pain. Studies of the sensitivity of the articular structures indicate that it is unlikely that the pain of the osteoarthritic hip results directly from the movement on each other of irregular articular surfaces. The instant relief of pain by osteotomy makes it unlikely that the pain is caused by an alteration of osseous vascularity. All present evidence suggests that the factor chiefly responsible is tension in the sensitive articular capsule and in the inflamed synovial membrane.

Reduction either of tension—as by osteotomy—or of inflammation—as by injection of hydrocortisone—is sufficient to give relief from pain. Although many of the features of the pain are explicable on this hypothesis, much more work is needed before all of them can be satisfactorily explained.

Operative treatment

Arthroplasty. The operative treatment of the osteoarthritic hip is a subject which can be relied on to provoke brisk discussion among orthopaedic surgeons. It is, however, generally agreed that the ideal operation would produce a painless, stable and freely mobile joint. At present, no such ideal arthroplasty is available. Since the report of Smith-Petersen (1948) on 500 hips reconstructed by his method of "mold arthroplasty", many thousands of such operations have been performed and many new methods of arthroplasty have been described. In general the results have been disappointing, deterioration occurring in at least 50 per cent of the cup arthroplasties over a period of 5 years from operation and in a shorter time in the case of the arthroplasties of the Judet type. Although a certain proportion of permanently good results has been achieved, it has proved difficult to forecast which case is going to do well and which badly. The methods of critical analysis used by Shepherd in her review of 650 cases of arthroplasty (Shepherd, 1954) have done much to make this point clear and to make possible an accurate evaluation of results. It is this disappointment with the results of arthroplasty which has led many surgeons to sacrifice mobility of the hip when dealing with cases where such a sacrifice can be tolerated by the patient. In most cases the production of a painless and stable hip is welcomed by the patient as an alternative to persistent pain and restriction of activity

Arthrodesis. In a proportion of patients the presence of advanced osteoarthritis of both hips either contra-indicates arthrodesis or means that arthrodesis of one hip must be followed by an arthroplasty of the other, even if that arthroplasty involves the sacrifice of stability In general, however, arthrodesis is the most certain method at present available for the relief of pain in the affected joint, the loss of mobility being as a rule well tolerated. Watson-Jones and Robinson (1956) in a recent review have shown that it is untrue to say that it is difficult to obtain bony fusion or that stiffness of the knee is a common sequel of the operation. Indeed, Crawford Adams' recent experience with a modified form of Brittain's V-arthrodesis (Brittain, 1952) has shown that fusion can be secured without subjecting the patient to the discomfort of several months in plaster and to the possible risk of stiffness of the knee.

Displacement osteotomy. There has recently been a revival of interest in the operation of displacement osteotomy at the trochanteric level as a method of treatment for the osteoarthritic hip. This interest has been quickened, since the troublesome problem of post-operative immobilization has largely been overcome by the use of internal fixation such as Kessel's spline or the nail-plate method of Campbell and Jackson (1956). Osteotomy offers some of the advantages both of arthroplasty and of arthrodesis. That is, some degree of mobility is preserved, pain is usually relieved and stability is not considerably affected. While many surgeons take the view that the operation is chiefly applicable to elderly patients suffering

from osteoarthritis of both hips, some men feel that it has a much wider range of application.

Campbell and Jackson have analysed the results of 46 osteotomies for osteoarthritis. They find that in 25 the relief of pain was complete and that in a further 15 the amount of residual pain was slight. This relief of pain was achieved with the sacrifice of very little mobility. These workers raise an interesting point regarding the mode of action of osteotomy in relieving pain They show that displacement of the shaft of the femur thought necessary by McMurray (1939) is not in fact essential for success. This seems to indicate that the division of the femur is the vital part of the operation, possibly acting to relieve pain by allowing the capsule to take up a position of maximal relaxation. This idea, first put forward by Lloyd-Roberts (1955), is well supported by the known anatomy of capsular changes in osteoarthritis. Were it the sole reason for the relief of pain, it would be expected that the pain could be relieved in the conscious patient by putting the hip in the position of maximal capsular relaxation. It is clear that further work along these lines is needed Another interesting point raised by the work of Campbell and Jackson is the fact that there seems to be a tendency to steady improvement for a considerable time after osteotomy. It is this fact, together with the apparent reappearance of joint space in the affected hip (Wardle, 1955), which has led some surgeons to a wide application of the operation. It is argued that osteotomy sets the stage for natural healing of an osteoarthritic hip, and that the reappearance of joint space in the radiographs indicates regeneration of articular cartilage. These arguments cannot be accepted without [illegible]

finding of an increased joint space in radiographs taken only two weeks after operation. Also, if radiographs of the hip are taken with the hip passively moved under anaesthesia into various positions, it is seen that the joint space increases and decreases according to the position adopted.

Conclusion

In the writer's view, osteotomy is a valuable procedure for the relief of pain without the sacrifice of mobility; more reliable than arthroplasty in regard to relief of pain but less reliable in this respect than arthrodesis. There is no reliable evidence of any beneficial effect on the pathological process—as was mentioned earlier, steady improvement may occur spontaneously. It is likely that osteotomy gives relief of pain for long enough to tide the patient over the acute phase and that any later improvement would have occurred irrespective of any operative procedure. Further work on the causation of pain in the osteoarthritic hip is badly needed.

INTERNAL PROSTHESES FOR FRACTURE AND ORTHOPAEDIC SURGERY

The idea of repairing a broken bone or replacing a diseased one by an internal prosthesis has always been attractive, and surgeons have been using such methods for many years and with varying degrees of success. The development in recent years of new materials has led to a considerable increase in the use of internal prostheses, so much so that a great deal of information is now available on the

reaction of the tissues to the implants and on the behaviour of the implants in the body. As Scales (1956) points out, much valuable information can be gained from an analysis of the failures as well as of the successes of these techniques.

The materials available are, broadly, metallic and non-metallic. The former group may be subdivided into two: ferrous alloys and non-ferrous (chrome-cobalt) alloys. The important members of the latter group are the acrylic resins, the polyamides and polyethylene. When these substances are implanted in the tissues, in a site where they are not exposed to stress or to abrasion the reaction of the tissues is insignificant and the material itself does not undergo any change. In practice, however, all implants are liable to be subjected to some kind of mechanical force and the behaviour under those circumstances of the tissues and of the implant is of considerable importance.

Metallic prostheses

Consider first the metallic prostheses. Stainless steel has the two important advantages of strength and of relative cheapness, but in guarding against corrosion it is not sufficient simply to use a steel of a composition known to confer a high resistance. Complete passivity of a stainless steel implant can only be achieved if surface polishing is very carefully carried out and if the process of manufacture has not produced stress at the grain boundaries (Scales, 1956) In addition, fatigue may occur as the result of intermittent stressing after implantation, leading to localized corrosion and to fracture. Electrolytic reactions may occur and cause corrosion, especially if two metals of different composition are in contact—as may occur in a plate and screw system (Wright and Axon, 1956). It is not possible at the present time for a surgeon using stainless steel implants to be certain that any two of them will be both chemically and metallurgically identical. Cater and Hicks (1956) have described simple tests by which clearly undesirable metals can be detected, but these methods are not accurate enough to guard against all possible dangers.

Consequences of corrosion

In whatever manner corrosion is determined, two consequences follow. The prosthesis itself is weakened and may break; and an inflammatory reaction with deposition of particles of iron occurs in the tissues. Such a reaction occurring in bone may weaken it enough to cause a fracture, as happened in the following case. In 1953 a Watson-Jones type of nail was inserted in the femur of a woman aged 66 years for the control of a trochanteric fracture. In 1957, without external violence, the femur broke at the point of entry of the nail. The radiograph (Fig 26) showed rarefaction at the site of fracture: so much so in fact as to raise the suspicion of a secondary neoplastic deposit. At operation for removal of the nail and fixation of the fracture an extensive granuloma was found surrounding the nail. The nail itself was corroded and was found to be strongly magnetic, and showed a negative reaction to tests for molybdenum with the reagent DL 12. Section of the granuloma showed numerous particles of iron embedded in the soft tissues.

Chrome cobalt alloys

In effect it seems likely that until these problems of the ferrous alloys have been solved and until a policy of standardization has been agreed on, surgeons will



FIG. 26.—Radiograph showing "pathological" fracture of the femur at the point of entry of nail, with rarefaction and apparent destruction of bone.

increasingly come to rely on chrome-cobalt alloys for prosthetic replacement where considerable strength is required. These alloys have a very great resistance to corrosion, in fact, an instance has yet to be reported of corrosion of an implant made of this material. Their manufacture is, however, an expensive process, and it is this fact which probably explains why in Great Britain there has been delay in bringing them into general use. A remarkable testimony to the value of these alloys is given by Moore (1957) in his survey of the results of using his self-locking hip prosthesis The implants have remained completely inert, and there has been no evidence of wear of that part of the prosthesis which replaces the femoral head. In some cases areas of increased density were seen in the parts of the bone subjected to stress, with hyperplasia of the bone in relation to the prosthesis. Moore mentions, too, a further point pertinent to the general question of prosthetic replacement. That is, that when mechanical imperfection resulted from the fitting of an instrument with too short a stem, rocking of the prosthesis with pressure necrosis of

bone was likely to occur. In general, it appears that a vitallium prosthesis constructed on sound mechanical principles will not undergo corrosion nor wear, that the tissues will not react unfavourably to its presence and that incorporation of the implant in the tissues can be expected.

Plastic prostheses

The great interest in replacement with plastic materials that was stimulated by the work of Judet and Judet (1950) led to enthusiastic and sometimes misguided use of these substances. The plastic materials are, of course, free from the hazard of corrosion, but their resistance to abrasion and to stress is less than that of steel and vitallium. The liability to fracture can be lessened by careful design and by reinforcement with metal, but the liability to abrasion is more difficult to overcome. This is a factor of some importance in the use of a plastic prosthesis to replace a



FIG. 27.—(a) Radiograph of hip joint one month after arthroplasty for osteoarthritis by the fitting of an acrylic "concentric cup".
(By courtesy of Mr. J. Crawford Adams)

joint surface, for abrasion will lead to the shedding of particulate material into the joint cavity with consequent synovial and capsular reaction. In this respect, the acrylic resins are the best, but it is likely that the use even of these should be restricted to the relatively lightly stressed joints of the upper limb.

Problems of internal prostheses

There are two problems common to both metallic and non-metallic implants. The first is the difficulty of achieving incorporation of the prosthesis in the tissues of the host. If the junction of the prosthesis with the tissues is mechanically inadequate to the stresses which may be imposed on it, there will be pressure necrosis of bone with rocking and loosening of the prosthesis. Secondly, any type of prosthesis applied to bone may deprive the bone in relation to it of its blood supply and may thus cause avascular necrosis. This has been seen by Crawford



FIG 27—(*b*) Radiograph of the same hip one year after operation, showing evidence of avascular necrosis of the re-modelled head of the femur.
(*By courtesy of Mr J Crawford Adams*)

Adams following the application of caps on the femoral neck in arthroplasty of the hip. The cap applied to the end of the neck of the femur may cause avascular necrosis of that part of the bone (Fig. 27 *a* and *b*), with consequent collapse and failure.

Conclusion

In conclusion, it may be said that although much has been learnt about the inter-reaction of the tissues and implants great care is still needed in selecting the right material and the correct design for the prosthesis and in choosing the right case for its application. It would greatly help matters if standardization of materials and of methods of manufacture could be brought about.

THE TRACTION LESION OF THE BRACHIAL PLEXUS

The complete supraclavicular injury of the brachial plexus is one of bad prognosis among traction lesions of nerves. The degree of residual disablement is often severe, and unfortunately, too, the injury is most common among young men with a long working life ahead of them.

Because most of these injuries are caused by motorcycle accidents they are often accompanied by other damage, such as head injury and fractures of the limbs which may interfere with the treatment of the paralysed arm. In a proportion of cases the damage to the lower roots of the plexus is less severe than that to the upper roots, and in these recovery of the less severely affected nerves takes place in a matter of a few weeks. In others, however, all roots are equally severely affected, and it is with this group that the present survey is concerned. Three problems have to be considered: (1) prognosis; (2) pain; and (3) reconstruction.

Prognosis

Prognosis is of the greatest importance, for it is necessary to know whether perseverance with conservative treatment is likely to be rewarded, or whether recovery is so unlikely to occur that reconstruction should be started without delay. It should be said at once that in these cases there is no question of operative repair of the neural lesion—the damage is always too severe and extensive to allow resection and suture or even resection and grafting.

Prognosis depends on two factors: (*a*) the site of the lesion; and (*b*) its severity. If the lesion is distal to the intervertebral foramen, recovery of any root so affected may occur provided that it has not been completely torn apart. Such recovery will proceed as for any axonotmesis, though re-growth of axons from the supraclavicular region to the periphery is certain to take a long time. It is quite likely that during that time irreversible changes will occur in the more distal muscles and in their motor end-plates, so that the outlook for these muscles is anyway poor. The same limitation does not apply to the recovery of sensibility, but here the complicating factor arises of the extreme likelihood of confusion of axons due to the distance of the lesion from the periphery. Such recovery of sensibility as may occur is liable to be of poor quality, discrimination both spatial and qualitative being likely to be defective. Even this degree of recovery is preferable to amputation and is worth waiting for.

In other cases, the damage to the individual root is proximal to the intervertebral foramen, the root being avulsed from the spinal cord. In such circumstances there is no hope of spontaneous recovery.

In any injury of the whole plexus these two types of lesion may coexist, some roots being damaged distal to the intervertebral foramen and some being torn from the cord. The physical signs of motor and sensory paralysis will be the same in either case.

Distinction between the two types of lesion on clinical grounds is to some extent possible in the case of the upper two roots, for the sparing or otherwise of the serratus anterior or rhomboids will give some indication of the level of the lesion. Lumbar puncture and myelography may be of help, for the finding of blood in the cerebrospinal fluid or the appearance of one or more meningoceles on myelography (White and Hanelin, 1954) are indications of a probable intradural rupture. Another and perhaps more reliable method of making this important distinction is, however, possible. In the case of a lesion distal to the intervertebral foramen there will be peripheral degeneration of both sensory and motor axons, while if the root has been avulsed from the cord the nutrient cells in the posterior root ganglion will remain in continuity with the peripheral sensory axons In consequence these will not undergo degeneration Thus, from the point of view of site of damage the lesions may be classed as post-ganglionic and pre-ganglionic (Bonney, 1954)

The presence of intact peripheral sensory axons can be detected by examination of axon reflexes in their distribution—in the forearm by study of the cutaneous [illegible]

would have occurred—some four weeks after injury—makes possible the distinction for each root between a post-ganglionic and a pre-ganglionic lesion. When the indications are that a given root has suffered pre-ganglionic damage it is reasonably safe to assume that there will be no recovery in the distribution of that root When it appears that a root has suffered post-ganglionic damage there is a possibility of recovery dependent on the severity of the local damage This point is difficult to settle without direct inspection by exploration. The occurrence of Horner's syndrome is no indication of the severity of the damage, and in all cases the initial depth of paralysis is likely to be the same Some clinical guide may be given by the presence or otherwise of associated fractures in the affected limb, the presence of a fracture around the shoulder indicating that the damage is likely to have been severe In most cases, however, exploration will be necessary, but this is not a simple matter, for the scarring is often considerable and landmarks are difficult to identify. Probably the best method is by a transverse incision in the [illegible]

ing fibrosis makes it easy to damage the vessel or the dome of the pleura One of two findings may be expected. Either the plexus is torn completely across, or it is found in continuity, thickened, scarred and hard. In the former circumstance the prognosis is hopeless, in the latter it is worth waiting for recovery. Funicular biopsy may occasionally give some useful information; for instance, the presence of regenerating fibres distal to the site of the lesion.

Summary

To summarize the plan for a case of complete supraclavicular traction lesion of the brachial plexus: in the first 6–12 weeks after injury the policy is an expectant one, for in some cases recovery of mildly affected roots may occur during this time. The limb is elevated to prevent oedema, and passive movements and electrical stimulation are given. At the end of this first expectant period the axon reflexes are tested to determine the distribution of pre-ganglionic and post-ganglionic damage. The possibility of recovery of any root showing pre-ganglionic damage is discounted—should the whole plexus have suffered such damage reconstruction is started without delay. In the case of predominantly post-ganglionic damage the plexus is explored in order to make the distinction between a lesion in continuity and a complete tear-across. If the former is found, then a second, longer, period of expectant treatment is begun, going on until no further recovery can be expected If the plexus is found to be torn apart, reconstruction can be started without further delay This plan simplifies to some extent the question of dealing with these difficult cases, and avoids the potentially misleading exploration in a case of pre-ganglionic damage In such a case, with the lesion well proximal to the field of exploration, the plexus might appear relatively normal, and in consequence an unwarrantably good prognosis might be given. This would, in turn, lead to a long and fruitless period of waiting for recovery and would waste time which might otherwise be spent in reconstruction and in rehabilitation.

Pain

Pain is a frequent and troublesome complication of a traction lesion of the plexus. In this respect the traction lesion of the brachial plexus is again different from traction lesions elsewhere, in which pain is nothing like so frequent nor so severe. The pain, usually referred to the periphery, is rather constant in nature, though there are sharp exacerbations sometimes provoked by handling the limb or by movements of its joints. The quality of the pain is usually burning and it is commonly severe and intensely distressing to the patient. It will very often start quite soon after the injury and may be persistent for many months or even years Very little is known of the mechanism of this pain. It is more commonly found in association with the pre-ganglionic type of lesion, and this finding suggests that it [illegible] means [illegible] in association with post-ganglionic lesions must be postulated.

All methods of treatment are unsatisfactory. Neurolysis of the plexus may be [illegible] rarely lasts long [illegible] pain being replaced by other equally disagreeable sensations. [illegible] followed by a painful phantom limb. In some cases the apparent relief of pain by injection of Novocain into the sympathetic ganglia has led to the performance of cervical sympathectomy. The results of this procedure are almost always disappointing, and this finding is a warning to caution in interpreting the results of sympathetic block. Not only may the relief of pain by ganglionic block be due to

the systemic absorption of the anaesthetic agent, but it may also be due to the psychological effect of the injection. Thus, what might at first sight seem an agreeable way of controlling the results of Novocain block by the similar injection of normal saline solution into the ganglia is, in fact, useless on account of the similar psychological effects of the two injections. The only way of knowing whether sympathectomy will relieve pain is to perform such an operation, and this, in view of the known failure of most of such operations, is hardly a justifiable procedure.

In the writer's view, the patient should be told initially that the pain is no indication that anything is going wrong, and that it will almost certainly subside in the course of time. Thereafter, when in conversation with the patient, it should be minimized or not mentioned, so that as little opportunity as possible is given to the patient to dwell on the pain or to consider it a major portion of his life.

Reconstruction

Reconstruction of the damaged limb may be considered in relation to four types of residual paralysis.

(1) Paralysis of the whole limb, both sensory and motor, with a functioning trapezius, with or without sparing of the serratus anterior, sensory paralysis below the elbow.

The choice in such cases is between amputation through the arm with arthrodesis of the shoulder, and reconstruction of the paralysed arm. The chief advantage of the former method is that it allows the patient to return to some kind of modified work in quite a short time. The procedure is simple and effective, the ulna being used as a graft for the arthrodesis and fusion usually being easy to achieve It is wise to aim at having only a little abduction of the arthrodesed shoulder, as this gives the best possible function after the fitting of a prosthesis. Many patients, when offered the choice between amputation and reconstruction, will choose the former in the opinion that they are getting rid of a useless member and are taking the shortest possible route to rehabilitation.

On the other hand, a good deal can be done with the apparently useless arm, even though the hand and forearm are permanently insensitive.

A patient of average intelligence will soon learn to take care of the hand so as to avoid damage to the skin and chronic ulceration.

If reconstruction is contemplated, three problems have to be tackled: (1) the transference of the action of the trapezius and serratus anterior to the arm; (2) the control of the flail elbow; and (3) the conversion of the hand and fingers into a hook. The first problem is dealt with by arthrodesis of the shoulder. The second may be dealt with by posterior bone block of the elbow, but the results of this procedure are not uniformly satisfactory. Perhaps a better solution is the fitting of some form of splint to the elbow. In this connexion Mr. Oakley of the Royal National Orthopaedic Hospital has designed a splint of light construction fitting to the arm and forearm and hinged at the elbow, with a ratchet device which enables the elbow to be locked in flexion and to be released by the patient's sound hand With the arthrodesed shoulder the patient is able to swing the arm so that the elbow flexes and is locked at a right-angle by the ratchet. The forearm is thus available as a rigid bar through which objects can be lifted and held in the "hooked"

hand. The hand and wrist are made into this "hook" by arthrodesis of the wrist and tenodesis of the flexor muscles. An arm so reconstructed is of definite functional use to the patient, though of course the time spent in this reconstruction is very much longer than that required for amputation. Alternative procedures are those devised by Hendry (1949) and the fitting of a splint to the elbow with its hinge activated from the sound arm.

(2) Motor paralysis as in the first type, but with recovery of the pectoralis major; sensory paralysis as in the first type. Here the opportunity occurs of obtaining active flexion of the elbow in addition to activating the arm and converting the hand into a hook. Clark's technique of transference of the pectoralis major to act as a flexor of the elbow (Clark, 1946) is of great value in such a case, especially when the recovery of power in the muscle is of a high standard. The occasional disappointing results of this procedure are usually due to over-estimation of the power of the pectoralis, and in such a case some form of splintage for the elbow will have to be used. Sometimes the addition of a ratchet splint is enough to allow the elbow to be locked by the active contraction of the transferred muscle which otherwise would not be sufficiently strong to maintain the position of flexion.

(3) Recovery of the scapulo-humeral muscles and of the flexors of the elbow. In such cases the only problem to be faced is that presented by the hand, and the method outlined above is satisfactory for this.

(4) Good recovery of scapulo-humeral and brachial muscles with partial recovery of ante-brachial muscles. In such cases there is also usually useful recovery of sensibility in the hand. Much can be done with such a limb by suitable transfer of forearm muscles, with or without arthrodesis of the wrist to free muscles for use in activating the fingers (Brooks, 1949). Recovery of power in the intrinsic muscles of the hand is a rare event, and in favourable cases the opportunity arises of obtaining opposition of the thumb and flexion of the metacarpo-phalangeal joints by transference of long muscles.

The point should be stressed that most of the reconstructive procedures which can be used depend on the maintenance of a full range of passive movement of the joints of the arm. This aim may not always be easy to achieve, for associated fractures may interfere with physiotherapy and the tendency to oedema and joint stiffness in these paralysed arms is very strong. Also, it is often difficult to secure continuous co-operation from the patient during the very long period of waiting for recovery. It is easy for him and for those treating him to lose heart after 6 months of apparently fruitless treatment.

POTT'S PARAPLEGIA

Griffiths, Seddon and Roaf (1956) have combined their experience of the management of Pott's paraplegia to make a comprehensive study of this condition. A series of 175 unselected and 53 selected cases has been studied. The clinical features of Pott's paraplegia are discussed, and it is shown that further experience makes it difficult to draw the sharp dividing line between paraplegia of early onset and of late onset which was considered important by Butler and by Seddon in their earlier work (Butler, 1935; Seddon, 1935). The limitations of radiography and myelography in providing helpful additional information are pointed out, and a

warning is given against regarding the absence of spinal block at lumbar puncture as an indication of favourable prognosis in a case of paraplegia of late onset.

Pathology and prognosis

As regards pathology, in half of the cases the cause of the paraplegia was an inflammatory process, and in the other half, more or less solid material was compressing the cord There was a higher incidence of inflammatory causation in the cases of early onset. In considering prognosis, results in patients seen between 1933 and 1945 have been analysed. Four out of 10 patients did not recover from the paraplegia, and 2 out of 10 died from it. Age at onset has some influence on the mortality, the death rate in children under the age of 10 years being half of that in patients between the ages of 11 and 40 years. The type of paraplegia does not seem to have any definite bearing on prognosis. The effect of antibiotics cannot be assessed from the present work.

Treatment

Reviewing the treatment of Pott's paraplegia, the authors discuss the limitations of conservative methods, but show that these still have a place in the favourable case. They trace the development of operative treatment, with special reference to the procedure of antero-lateral decompression. The technique of this operation is described and 50 cases so treated are reviewed. There were 4 deaths, 10 failures and 36 successes. Favourable factors were the finding of a soft compressing agent and short duration of bony disease and—to a lesser extent—of paralysis. They compare these results with those of costo-transversectomy, and indicate the role of that operation in the case where compression is due to fluid pus under tension. Laminectomy is recommended only for the rare cases of paraplegia due to posterior disease, for "spinal tumour syndrome", and for paraplegia in cervical disease not responding to conservative treatment.

Indications for surgery

Absolute indications for operation in Pott's paraplegia are as follows:

(1) Paraplegia arising while the patient is under adequate conservative treatment.

(2) Paraplegia deteriorating while the patient is under adequate conservative treatment.

(3) Complete motor paralysis for one month

(4) Circumstances making conservative treatment specially difficult, such as severe flexor spasms or a severe degree of spasticity.

(5) Paraplegia of rapid onset, indicating severe pressure.

(6) Very severe paraplegia.

Summary of management

In a summary of the management of the ordinary case, the authors recommend an initial 6 weeks' conservative treatment, with costo-transversectomy if a well-marked paravertebral shadow is present. Operation is recommended if at the end of 6 weeks there is deterioration or if there is no improvement Even cases of late onset may do well after antero-lateral decompression, as in some of these an inflammatory cause is found or a compressing bony ridge is found to be removable.

ABSTRACTS RELATING TO ORTHOPAEDIC SURGERY

Thoracic outlet syndrome

Treatment

Muscular development.—A simple scheme for muscle development to elevate the shoulder girdle and thereby relieve the symptoms of the thoracic outlet syndrome is described by PEET, HENRIKSON and ANDERSON (1956). They point out that the symptoms are caused by mechanical pressure at the thoracic outlet and that the particular structure involved varies in different patients, hence the various names previously given to this condition. In many cases the commonly recognized structures, such as a cervical rib,

females. Symptoms rarely develop under 14 years of age and two-thirds of cases begin between the ages of 20 and 40 years, when further drooping may occur. Reports are

patients at home. The results on 55 patients are given (20 men and 35 women); 6 were completely relieved, 33 were improved, 14 unchanged and 2 were worse. Those with x-ray evidence of a possible pressure factor showed the same proportion of clinical improvement as those with none. The shorter the duration of symptoms the better was the chance of improvement and in general this was noted in the first four weeks The recommended exercises consist of graduated movements which exercise the shoulder elevators against increasing resistance.

Low-back and sciatic pain

Treatment by hydrocortisone injection

FEFFER (1956) describes the treatment of low-back and sciatic pain by the injection of

gressive neurological symptoms The first 25 believed that they were undergoing a diagnostic test and those who responded were surprised at their alleviation of symptoms. Response was evaluated by relief of pain, spasm, scoliosis, sciatic irritability and neurological findings, on this basis, remission was obtained in 37 patients, in 32 of whom it was complete. Correlation between the interspace involved and the number of remissions obtained showed that 54 per cent lesions were at the lower lumbar levels, 16 per cent at the fourth interspace, 24 at both. Three cases are reported. In 16 of 18 failures, surgical exploration of the involved discs demonstrated irreversible changes. Results suggest a method of interrupting the course of an acute intervertebral disc herniation and of demonstrating early in the condition which discs require surgical intervention.

Osteoarthritis of the hip

Treatment by osteotomy

CAMPBELL and JACKSON (1956) discuss the treatment of osteoarthritis of the hip by osteotomy, remarking that an ideal treatment would give a painless and stable joint with

full movements and no shortening. Pain is the symptom which usually persuades the

were entirely freed of pain and in only 6 was failure to be admitted. Sacrifice of some mobility is frequent after this operation and in 6 of their cases no mobility remained,

before the intervention but after it he hiked thirty miles in a day.

Legg-Perthes disease

Two case reports

necrosis of the femoral head and disruption of the epiphyseal plate, the cartilage of which was fibrillated and the cells clustered, the line of endochondrial ossification was irregular. Large tongues of deranged cartilage extending deep into the femoral neck, showed the epiphyseal plate lesion to be the primary one and of long standing. The necrosis of the bone and bone marrow of the femoral head appeared to be recent. Epiphyseal necrosis results from traumatic impairment or occlusion of the retinacular vessels as they cross the cartilage of the disrupted epiphyseal plate, before reaching the ossifying femoral head. The degeneration of the cartilage closely simulates the early changes of

aminonitriles

Paralytic scoliosis

Prognosis

creates an elevation of the trapezius line of the neck, which develops a compensatory curve in the opposite direction, and the head appears to droop between the shoulders. In 20 cases, the iliac apophyses reached to the posterior superior spine, usually the end-point of paralytic scoliosis. The prognosis of untreated or conservatively-treated curves is poor; early prophylactical surgical fusion is therefore indicated. The records of the poliomyelitis patients showed a group of 38 with unilateral arm-trunk involvement but no intercostal impairment. In thoracic paralytic scoliosis, the upper limit of the primary curve was at or below the 3rd thoracic vertebra. The prognosis was distinctly better than in the high thoracic group in which intercostals seemed to be the only consistently paralysed muscles on the convexity of the curve. An important deformity from intercostal paralysis is rib droop, the ribs being crowded on the convexity and lying almost vertical, in contradistinction to their position in idiopathic lesions. Thoraco-lumbar scoliosis involves from 6 to 13 vertebrae. In this series the most striking feature was the weakness of the lateral abdominal flexors on the convexity, of the erector spinae and of the anterior abdominal muscles. Pelvic obliquity occurred 11 times. Lumbar scoliosis is caused predominantly by the lateral abdominal flexors, and perhaps the latissimus dorsi, resulting in a pelvic tilt unaffected by manual traction on the leg. The prognosis is little better than in the former group and far worse than in the idiopathic forms. Combined thoracic and lumbar scoliosis is important in that fusion of only one primary curve may be followed by disastrous increase in the second Telescopic spine occurred eight times, with gross but symmetrical anterior, lateral abdominal and erector spinae paralysis. In idiopathic scolioses, the site of the primary curve is more important in prognosis than the age at which curvature begins. In paralytic forms, the primary site is less important than the degree of muscle imbalance.

Clinical considerations

ROAF (1956) discusses paralytic scoliosis, confining most of his remarks to those cases caused by poliomyelitis He states that electromyography shows that in some cases the condition is due to localized muscle paralysis when it is described as idiopathic. In any consideration of posture it is usual, when dealing with the trunk, to group muscles as spinal or extra-spinal, the former are found in the superficial longitudinal group and the latter in the deeper or transverse group. All muscles in both groups play a part in maintaining posture If a deformity is described as convex to the right it indicates that the vertebrae at the apex of the major curve are shifted and their bodies rotated to the right; as a rule the major curve determines the other ones and is usually the most fixed and the earliest to appear. Sometimes, as in general collapse, one cannot say which is the primary curve In the adult spine the shape of the bones and the nature of their attachments give a considerable degree of stability, but in younger persons this is not the case. It is said that the curves due to paralysis are longer, more mobile, less acute and less severe than in the idiopathic condition. There are two main disabilities from this. In the first we find the distortion of the abdominal and thoracic viscera and the second is the spinal disability; sometimes deformity is marked but weakness not so evident. In other patients weakness is considerable but deformity not very great. There are four main types of deformity. These are the general thoraco-lumbar C curve, the cases with general collapse. Then the primary lumbar curve may be due to pelvic obliquity and imbalance of the trunk muscles and finally we have the primary thoracic curve. Primary cervical curves are not dealt with here; they are rare Pelvic obliquity and loss of abdominal symmetry are frequent factors. Considerable interest attaches to unilateral paralysis of the psoas but it is doubtful if it is important After an attack in childhood a slight deformity may remain but will often be aggravated in a period of rapid growth In the acute attack overstrain of a temporarily paralysed muscle is most harmful and this should be prevented. Prophylactic tendon transplants, stapling to cause epiphyseal arrest and bone grafts all have their value.

Paralytic foot deformities

Tendon transplantation

MORTENS and PILCHER (1956) describe tendon transplantation as used to prevent foot deformities after children have been ill with poliomyelitis. It has been shown that in leg

occurs mostly from muscle imbalance, structural changes occurring later. Operation should rarely be performed before five years and then only after a year's conservative

calcaneus tendon may need intervention before other measures are of any use. Good functional results may be found even though deformity is considerable

Flexor tenodesis

Provision of automatic grasp

Wilson (1956) describes the provision of automatic grasp by flexor tenodesis. An automatic mechanism providing the basic functions of grasp and pinch and simulating the normal mechanism can be achieved by tenodesis of the long flexor tendons of the

occupational therapy, however, are necessary to obtain maximum function

Syme's amputation

Factors making for success or failure

The precautions needed to make a success of Syme's amputation are described by Harris (1956) Authorities differ concerning the value of this procedure and this dis-

and to get the best results the bone must be severed where it has its greatest cross section,

while the whole of the area exposed must be usable. This is most easily done when there is strong cancellous bone and the tibia in its higher levels has not this structure. The skin must also be suitable and in the leg this is only found at its best at the lower end of the femur or at the lower ends of tibia and fibula covered by the pad of the heel. The special structure of this pad makes it more suitable for weight bearing than skin from the sides of the leg since the fat is contained in fibrous loculi which are tough and strong. To preserve this in full usefulness it is important to make a subperiosteal dissection of the calcaneum and not to dissect it through the subcutaneous plane. The incisions needed to do this satisfactorily were carefully studied by Syme. It is important to place the heel flap correctly under the tibia and keep it there until sound healing has occurred. This is best achieved by using adhesive strips at the end of the operation. The area must be examined frequently until healing is complete. To provide a surface parallel with the ground some shaping of the tibia may be needed. Sometimes gangrene of the heel flap develops or the flap has too poor a blood supply causing pain in cold weather, though this hazard is less common in the Canadian winter than in Great Britain. Syme's amputation has some shortcomings as a bulky and heavy prosthesis is needed, though with new materials this is becoming less true.

Hallux valgus

Aetiology

LAKE (1956) reviews the problem of hallux valgus, a condition commoner in the shod than the unshod, in women than in men, in middle-aged than in adolescence or childhood. No special form of footwear nor relative lengths of the metatarsal bones have any proved aetiological significance. The theories are that hallux valgus is produced by pressure of defective footwear; that the displacement of the toe is secondary to a primary metatarsal divergence; that footwear is an indirect factor; these theories are discussed. Hardy and Clapham (1952) in a statistical radiographic study of the angulation between the phalanx and metatarsals in 1,851 children concluded that the deformity preceded the metatarsal displacement, a result contradicting theories 2 and 3.

More important, in the author's opinion, is the mechanical factor contributed by the adductor and flexor brevis muscles and the deep transverse ligament. He has produced a model showing that a deviation of the metatarsal of only 1 degree produced a toe valgus of 4 degrees. In hallux valgus an anterior metatarsal divergence beyond the normal 15 degree to 20 degree constitutes "spread-foot". A congenital [illegible] metatarsal, metatarsus primus varus, suggests the [illegible] dent upon an atavistic weakness McDou[illegible] An almost constant manifestation in hallux v[illegible] ligament with the great toe, due to the attachments of the muscles and deep tra[illegible] plantar aspect of the base of the phalanx. Deviation of the metatarsal, however, remains the most important factor, the forces involved being the rising of the bones to the "take off" position and the transmission along them of the body weight. If the forces are excessive or the structure weak, spread follows, a raised heel increasing the effect. A second hammer toe is constantly associated with hallux valgus and is secondary to the transference of stress to the second metatarsal. Certain operative measures in hallux valgus have been devised to restore the metatarsal to its original position. In the author's technique, all structures inserted into the lateral aspect of the base of the phalanx are detached and, after excision of the lateral sesamoid, are drawn through an oblique tunnel to be freshly inserted into the metatarsal head.

Fibrous metaphyseal defect of bone

Clinical and pathological features

MAUDSLEY and STANSFELD (1956) discuss a fibrous metaphyseal defect of bone which was not of osteogenic origin. A group of 10 cases was observed. The first of these, a young boy, noticed a swelling on the outer side of the left leg and was found to have a thickening about two inches long and seemingly fixed to the left tibia. Radiographs showed an irregular cavity in the lower part of this bone but other parts of the skeleton were normal.

At operation the outer side of the tibia was found slightly expanded but there was no definite soft tissue swelling. The cavity of the bone was opened and seemed to contain [illegible]

[illegible] spontaneously.

"Pseudohypoparathyroidism"

A clinical entity entitled "Pseudohypoparathyroidism" is described by JACKSON (1956) [illegible] the [illegible] was [illegible] ads. [illegible] tion showed that in many also there was abnormal calcification mainly in the basal ganglia and cerebellum and also in the subcutaneous and connective tissues of the legs. Exploration of the parathyroid glands showed normal or hyperplastic glands and it is suggested that the renal tubules fail to respond to parathormone. Treatment consists of massive doses of vitamin D.

Fractures of the odontoid process of the axis

Clinical features

BLOCKEY and PURSER (1956) describe fractures of the odontoid process of the axis. [illegible]

[illegible] inner aspect of the lateral mass on the other side. [illegible]

[illegible] tions of taste to be causes of complaint. There may be associated fractures, as of the

mandible, but in the writers' series only one had fracture of the axis also. Paraplegia developed in 11 out of 22 patients with forward displacement and in one who had no displacement. It may be gradual or sudden in onset, occur early or late or be intermittent. A caliper holding the vault of the skull helps in reduction; general anaesthesia is undesirable. The reduction is finally held in a plaster.

Fractures of femoral neck

Arterial supply to head of femur

Arteriographic study.—MUSSBICHLER (1956) discusses the arterial supply to the head of the femur and presents an arteriographic study *in vivo* of lesions attending fracture of the femoral neck. The nutrition of the femoral head is supplied by the medial circumflex artery of the thigh and the ligamentum teres artery. The former springs from the deep femoral, traverses the dorsal aspect of the femoral neck and continues in the substance of the capsule and periosteum to the head, the upper capsular artery and its branches supplying the major part of the epiphysis. The remainder may be supplied by the ligamentum teres artery, stemming from the obturator to enter the pit in the femoral head, the chief role of this vessel, however, is probably to compensate for a circulatory disturbance of the capsular vessels. Contrast medium, in the form of white lead, was injected into the external iliac artery. At the level of the intertrochanteric notch the posterior collum branch of the medial circumflex artery was seen to give off the superior synovial vessels and immediately after its origin, the inferior synovial. The contrast medium in the ligamentum teres artery was mainly conveyed by an acetabular branch of the medial circumflex. Arteriography was carried out by injecting the femoral artery at the level of the inguinal ligament with 50 per cent Diodone. The 28 diseased hips examined included necrosis of the femoral head (4); pseudo-arthrosis (2); acetabular metastasis (1); Perthes' disease (4); Judet's plastic operation (1), as well as 3 pertrochanteric and 11 medial fractures of the neck. The second hip was examined in 15 cases. In the posterior collum branch of the medial circumflex artery in the diseased hips demonstrable local changes were dilatation in 6 cases, decreased rate of flow in 8; arrested circulation in 7; the obstruction in every instance being in the central portion of the vessel. In 4 of these cases the rate of flow in the proximal portion of the artery was also reduced. Six cases, characteristic of these lesions, are described. Dilatation of the posterior collum branch is suggestive of hyperaemia following tissue damage or a vascular injury not capable of demonstration. Decreased rate of arterial flow may be due to stasis in main or peripheral vessels. Arrested circulation, even temporary, may result from obliteration of vessels from rupture, torsion or thrombosis.

Fractures of tibial condyle

HOHL and LUCK (1956) review fractures of the tibial condyle in 726 cases, including undisplaced, displaced and split fractures. There were 44 open reductions by which the depressed articular surface was restored and internal fixation, frequently supplemented by bone grafts, commonly performed. In 227 cases followed-up, "acceptable" results demanded reduction of the fracture within 3 millimetres; no more than 5 degrees increase in varus or valgus deformity; minimal or no joint degeneration; 90 degrees of knee movement. "Unacceptable" results were inadequate reduction; valgus or varus deformity; degenerative joint changes, less than 90 degrees of knee movement; lateral instability and pain. Among the undisplaced fractures, treated predominantly by cast immobilization, full weight-bearing was resumed in approximately 4 months. In patients treated without a cast, however, earlier movement and weight-bearing were obtained. Of 132 follow-up cases of comminution and depression of the condylar articular surface treated by cast immobilization, 37 per cent showed depressions of 1 centimetre or more. The poor anatomical results indicated the advantage of surgery. Residual varus or valgus deformities, occurring in over 40 per cent, demonstrated a significant relationship between the depth of depression and the degree of valgus. The better functional results were directly related to the depth of depression and did not depend upon open reduction. In 47 cases of total-depression fracture, the initial valgus or varus deformity was permanent unless

manipulative reduction under anaesthesia was obtained The functional results were

Fractures of the lateral tibial condyle

Treatment by skeletal traction and early mobilization

Some surgeons prefer to use skeletal traction and exercises and the writer considers this the best procedure. After aspirating any blood in the joint a pin is inserted two inches below the fracture and, if displacement is marked, an attempt at reduction is made by traction on this and compression at the knee The patient is returned to bed with ten pounds weight traction and the knee and calf resting on a pillow. Knee straightening and leg raising exercises are started the next day. Within 4 weeks it should be possible to control extension and have flexion at least to 90 degrees After 6 weeks the pin is removed and the patient gets up on crutches but puts no weight on the leg at first He does this later by stages. After 12 weeks he should walk without any aid, unless nervous or feeble, though radiographs are used to satisfy the patient they are scarcely needed. In a group of 60 cases 48 were treated without plaster or operation and 27 which were followed up have had good results The writer feels that the term "bumper fracture" is misleading as the injury is a valgus split or crush It is also considered that plaster cannot be very effective in controlling a fracture of this kind.

Low back pain

Experimental investigation into intervertebral disc pressures

Variations in the pressure exerted by the nucleus pulposus on the annulus fibrosus as a possible cause of low back pain is investigated by BUSH and his colleagues (1956) A preliminary investigation had shown that the nucleus could absorb enough fluid to cause pressures of between 8 and 300 centimetres of mercury, equivalent to 5 58 pounds per square inch, except in degenerate discs obtained from old people Further experiments

Bone metabolism

Effect of diet on mobilization of strontium from the rat skeleton

RAY and his colleagues (1956) review bone metabolism, particularly the effects of various diets on the mobilization of strontium from the rat skeleton. Investigation of various methods used to mobilize salts from the skeleton suggested that dietary measures affecting calcium and phosphorus metabolism offered one method for accelerating the mobilization of strontium. An experiment was, therefore, undertaken to compare the effects of some of these diets on body growth, histological bone structure, skeletal chemical composition and mobilization of strontium from the skeletons of young growing rats. One-hundred-and-sixty-nine male Long-Evans rats were weaned at 21 days and placed on standard laboratory diet. They were then given daily intraperitoneal injections of strontium chloride (2 milligrams per gramme of body weight) for 21 days, the dose being adjusted every 5 days. At the end of this period, they were divided into 7 groups and maintained on the respective test diets, sub-groups being brought to necropsy after 7, 14, 30, 50 and 64 days. The control group was fed the standard laboratory diet; the other 6 groups received respectively, high calcium and high vitamin D; cereal rachitogenic, cereal rachitogenic containing ammonium chloride, low-protein, subminimal phosphorus and low phosphorus diets. At necropsy, the tibia was removed for histological sectioning, the femur for chemical analysis. Quantitative determinations of strontium were made with the Weichselbaum-Varney flamephotometer. The animals on high calcium and subminimal phosphorus diets showed slower gains initially than the controls, but at ... oximately the same. The gain of rats ... cent less than the controls at 64 days, ... age of 11 grammes in body weight ... es during 50 days. Histologically, the ... e rachitogenic diet resulted in widen- ... rrounding the trabeculae, while the ... ber of trabeculae. The subminimal ... horus and low-protein diets delayed growth and narr ... composition of the femur occurred ... In rats on the l ... decreased for 20; the final composition of the bone showing an increase in the percentage ... a decrease in water. On the low-protein diet, the ... of both inorganic-salt and water ... femur showed the low-protein diet ... and skeletal mineralization, the ...

Bone lesions

Localization of radioactive gallium

DUDLEY and his colleagues (1956) present studies of the localization of radioactive ... in bone lesions by external scintillation counting. In previous experi- ... inistered as the ... blastic activity. ... selected patients ... ed the injection ... made at 6, 24, ... outine scanning ... nd the scanning ... conditions, any

interruption of the blood supply materially reduces the concentration of ^{72}Ga and causes false positive results in the normal site. This was encountered in 7 cases. Of 66 cases of proved malignant lesions, 9, negative by scanning methods, gave no clinical or x-ray evidence of bone involvement. In 28 questionable cases, fair correlation between the [illegible]

differentials ranged from 1 14 to 1·17, in the healing stages, however, differentials of 1·30 to 2 40 indicated marked osteoblastic activity simultaneous with bone repair at the healing site In the case of fractures, ^{72}Ga scanning is valuable since the penetration of the gamma-ray makes localization of the lesion possible through the cast. In 29 fractures, the degree of ^{72}Ga localization was correlated with the time following injury and the healing process.

Bone regeneration

The two osteogenetic phases

[illegible]

tissue or whether properly stimulated connective tissue cells were also involved. From [illegible]

included. In experiments in which autogenous periosteum alone was transplanted into muscle, the periosteum shrank and necrosed; even if it was kept stretched, osteogenesis did not occur. Small pieces of cortical bone, however, implanted near the stretched periosteum resulted in some new bone formation Further experiments were made with frozen grafts, but up to the fourteenth day no histological evidence of osteogenesis was found, while the presence of periosteal necrosis proved that the osteogenetic tissue was [illegible]

necrotic bone, are thus unified

Bone fixation

Electrolysis and the use of stainless steel

Electrolysis and the use of stainless steels in bone are discussed by WRIGHT and AXON (*1956*). They note that the phenomena in a voltaic cell in which the anode is affected by electrolytic dissolution or corrosion may have their counterpart in metals fixed to bone. It is thought possible that the loosening of screws in a bone plate is not entirely due to mechanical causes but may partl [illegible]
to [illegible]
ele[illegible]
enc[illegible]
will rapidly enlarge the gap round itself. Experiments have been designed to show that when bone and screws through it are immersed in normal saline and a current is passed

through the [illegible]
in plasma ar [illegible]

[illegible]

them crystals of metallic sulphides so that a current may be set up between them and the mass of alloy itself. [illegible]

[illegible]

driver is forcibly applied to a screw when anodic material may actually be transferred from the former to the latter. Ideally all metals used for fixation should be chemically and metallurgically identical and the clamps and screwdrivers also. A small washer acting as an insulator between the plates and the heads of the screws might be useful in checking corrosion.

Epiphyseal stimulation

Clinical evaluation

[illegible]

femur and proximal end of the tibia. [illegible]

[illegible]

an increase of ¾ inch was obtained. In both these cases the *discrepancy in length was decreased in the year following surgery, confirmatory evidence that the ivory implants produced a temporary increase in the rate of growth. No unusual post-operative com*plicatio[illegible]
only ½[illegible]

[illegible] becoming greater and, in several instances, actually [illegible] in a child with a *discrepancy of an inch or more undergoing surgical relaxation of a tight iliotibial band, a successful stimulating procedure can be performed through the same incision. On the whole, however, the results do not justify the procedure.*

Growing epiphyseal cartilage and bone

Autoradiographic study of organically bound Carbon-14

[illegible] Carbon-14 [illegible]

[illegible]

matrix. By 24 hours, however, the matrix of the whole cartilaginous structure had become reactive, while the reactivity of the epiphyseal cartilage was decreased. At 72 hours this was further diminished, at the same time, the zone of degenerated and calcified cartilage contained labelled matrix. Formation of bone matrix in the long bone at 4 hours was seen as a periosteal band lying over the peripheral layers of diaphyseal bone and including the innermost layers of the membranous periosteum. At 24 hours this band of reaction

rate of matrix renewal may be a factor in the accrual of mineral salts in the zone of provisional calcification.

Homogenous epiphyseal-cartilage grafts

Experimental study

SCHNEIDER (1956) describes an experimental study in homogenous epiphyseal-cartilage grafts. Almost all bones are first formed as hyaline cartilage which later undergoes

Wear and tear in joints

Experimental findings

BARNETT (1956) discusses experiments on wear and tear in joints and notes that

water of a buffer solution was injected as a control. After 24 hours' continuous movement damage to the articular cartilage was constant on the test side and the joint surfaces were

seen to lack lustre and be discoloured much before this time elapsed. The effects of wear varied somewhat with the range of movement and the load applied to the limb, but the number of excursions per minute was kept constant. It became evident that the synovial cartilage acted very much as a sponge through which the synovial fluid passes either way. Light loading and rapid movement provide the most favourable conditions for joint lubrication and it is difficult to obtain this ideal condition when loading is heavy and movement slow. Recent work in other fields shows that colloidal dispersions of large, irregular or long chain molecules behave differently from pure oils of more simple structure. Their effective viscosity rises steeply when the rate of shear decreases and they behave like thick oils when movement is slow. Hyaluronic acid molecules confer this property on synovial fluid so that joints moving slowly are well lubricated. An enormous pressure is needed to squeeze synovial fluid between plates and in man the joint most heavily loaded is probably that between first metatarsal and its sesamoid bones. The efficiency of rubber coverings on bearings may be compared with similar conditions in joints.

Healing of fractures in rats

Studies with radioactive sulphur

The healing of fractures in rats is studied by OSBORNE and KOWALENSKI (1956) by determining the uptake of radioactive sulphur (^{35}S) at the fracture site. The investigation was based on the facts that there is a cartilaginous phase in the process of healing, that the amount is variable, but is increased if movement takes place at the fracture site and that there is a selective uptake of ^{35}S in cartilage. In 40 rats a fractured humerus was produced by digital snapping of the midshaft under anaesthesia. These were untreated and half were sacrificed at 3 weeks, 10 at 6 weeks and 10 at 8 weeks. Twelve rats had similar fractures produced but were treated by a shoulder plaster spica. Ten of these survived and were sacrificed at 3 weeks. All animals received 200 microcuries of radioactive sulphur intraperitoneally 24 hours before death. At necropsy the normal and fractured humeri were removed, dried, dissolved by a nitric, perchloric acid method and the organic sulphate precipitated as barium sulphate. The radioactivity of the precipitate was estimated with a counter and the result expressed as counts per minute. In a further series of 6 rats killed at 3 weeks the bones were removed, ground to a flatsheet and autoradiographs obtained. The results indicated that there was an increased uptake of ^{35}S in the fractured bone compared with the normal bone (radio 2·2 : 1) being maximum at 3 weeks and this uptake is much less in the bone which has been splinted (radio 2 : 2 : 1·6).

Healing of fractures in dogs

Influence of arteriovenous fistulas

JOHNSON and HENRIE (1956) give a preliminary report on an experimental study on the influence of an arteriovenous fistula on the rate of healing of fractures. This was based on previous reports of others that venous obstruction or stasis increases the rate of bone growth. Ten dogs were used; in the first two an arteriovenous fistula between the external iliac vessels was created. Only slight distal oedema occurred, and the vascular pattern was increased in the thigh and the thrill was readily palpable. The leg on the opposite side was warmer. Sacrificing the animals at 12 weeks they showed that there was a marked dilatation of the pelvic veins proximal to the fistula due to the venous return following alternative routes. In four dogs a transverse fracture of the femur was produced and stabilized by intramedullary Kirschner wires. One week later an external iliac arteriovenous fistula was formed in each of these animals after which it was observed that a grade 4 pitting oedema developed which subsided over 10-14 days. As the oedema regressed the vascular pattern in the thigh became more evident. One dog was sacrificed as the persistent oedema was due to thrombosis of the external iliac vein. The remaining dogs were used as controls, the fractures only were produced and treated. The healing of the fractures was studied by serial x-rays. Callus formation was evident by the second week in all cases but was more prolific in the control group. The authors conclude that the arteriovenous fistula made little difference, but their experiments are continuing.

REFERENCES

Adams, J. C. Personal communication.
Apley, A. Graham (1956) *J. Bone Jt. Surg.*, **38B**, 699.
Arden, G P., and Veall, N (1953). *Proc. R. Soc. Med.*, **46**, 344.
Axhausen, W. (1956). *J Bone Jt Surg*, **38A**, 593.
Barnett, C. H. (1956) *J. Bone Jt. Surg.*, **38B**, 567.
Blockey, N. J, and Purser, D. W (1956). *J Bone Jt. Surg*, **38B**, 794.
Bonney, G L. W. (1954) *Brain*, **77**, 588
Brittain, H. A (1952) *Architectural Principles in Arthrodesis* 2nd Ed. Edinburgh; Livingstone.
Brooks, D. M. (1949). *Proc R Soc. Med.*, **42**, 838
Bush, H. D., Horton, W. G, Smare, D L, and Naylor, A (1956) *Brit. med. J*, **2**, 81.
Butler, R. W. (1935) *Brit. J. Surg*, **22**, 738
Campbell, J. P., and Jackson, J. P. (1956) *J. Bone Jt. Surg.*, **38B**, 468.
[illegible]

University Press.
Harris, R. I. (1956). *J. Bone Jt Surg.*, **38B**, 614.
Hendry, A M. (1949). *J. Bone Jt Surg*, **31B**, 42
[illegible] 001.

[illegible] *Clin*, **31**, 276.

[illegible]

[illegible] *Acta radiol Stockh*, **45**, 533.
Osborne, J. C., and Kowalewski, K. (1956) *Surg. Gynaec. Obstet*, *Brit Emp.*, **103**, 38.
[illegible]

[illegible] *J. Bone Jt Surg.*, **38B**, 640.
Scales, J. T (1956) *J. Bone Jt Surg*, **38B**, 754.
Schneider, M. (1956) *J Bone Jt. Surg*, **38A**, 601.
Seddon, H J (1935) *Brit. J Surg*, **22**, 769
Shepherd, M M. (1954) *J. Bone Jt. Surg*, **36B**, 567.
[illegible]

Surg., Chicago, **23**, 715.
442.

Tucker, F. R. (1950). *J Bone Jt. Surg.*, 32B, 100.
Wardle, E. N. (1955). *J. Bone Jt. Surg.*, 37B, 568.
Watson-Jones, R. (1936) *Brit. J. Surg.*, 23, 787.
— and Robinson, W. C. (1956). *J. Bone Jt. Surg.*, 38B, 353.
White, J. C., and Hanelin, J. (1954). *J. Bone Jt. Surg.*, 36A, 113.
Wilson, J. N. (1956). *J. Bone Jt. Surg.*, 38A, 1019.
Wright, J. K., and Axon, H. J. (1956). *J. Bone Jt. Surg.*, 38B, 745.

RECENT ADVANCES IN GYNAECOLOGY AND OBSTETRICS

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CARCINOMA OF THE CERVIX

Diagnosis

The diagnosis of carcinoma of the cervix has undergone a radical change in the past few years, due to the introduction of vaginal cytological methods. Malignant cells, individually or in clumps, can be distinguished from those normally present, whether they come from the cervix or from other parts of the genital tract This has made it possible for an earlier diagnosis to be made with consequent improved results in treatment. In a few cases, an attempt has been made to screen whole populations This, of course, is expensive and entails a large highly trained staff, including gynaecologists, cytologists and technical assistants. It is doubtful if the time and money spent justify the few malignant cases detected and it must be remembered that a diagnosis, often in doubt, requires a confirmatory biopsy. In established carcinomas, the older method of biopsy is all that is required to confirm the diagnosis and is more reliable than vaginal cytology.

Carcinoma *in situ*

A lot of research is still being undertaken into the exact nature of carcinoma *in situ*. Although some patients diagnosed as suffering from this condition have later developed true invasive carcinoma, others fail to show any change when observed over a number of years. In these cases, it may be argued that the whole of the growth was removed at a preliminary biopsy. Quite obviously, when a recognizable carcinoma is found, it must have started in a local non-invasive state, yet the multiplicity of changes in the distribution and nature of the cells in the genital tract under the influence of varying concentrations of hormones make it difficult, if not impossible, in the present state of our knowledge, to differentiate these very early carcinomas from other conditions which are similar in appearance. It would seem wise for the moment, therefore, to regard carcinoma *in situ* whenever found, as malignant, or potentially so.

Treatment by operation

The old controversy as to the best treatment between radiation and surgery, and the combination of the two, is not yet decided. This, however, is unimportant and it seems probable that both methods will eventually be superseded. In any case, the one should be looked upon as complementary to the other. On the whole, gynaecological opinion of late has swung in favour of surgery with its lowered operative mortality and better rate of survival. Some recent figures quoted by Meigs (1956a) are shown in the Table below.

TABLE

Treatment	Stage I *Cases*	Stage I *Cured*	Stage I *Per cent*	Stage II *Cases*	Stage II *Cured*	Stage II *Per cent*
Radiation	107	59	55	249	110	44·1
Surgery	104	77	74	33	17	51
Total	211	136	64·4	282	127	45

It seems likely, therefore, that surgery should be employed in all cases suitable for operation with or without preliminary radiation or post-operative radiation. The modern radical operation calls for a high degree of skill and an exact knowledge of the anatomy of the pelvis. The best results will be obtained with a permanent operative team including assistants and anaesthetists, careful pre-operative examination and evaluation of the patient, gentleness in handling tissues, reduction of blood loss to a minimum and a reasonable speed of operation.

Pre-operative care

Pre-operative care should include staging the growth, haemoglobin estimation with correction of the anaemia when indicated, cystoscopy for detection of bladder involvement, urine analysis and blood urea estimation to determine the renal efficiency, an intravenous pyelogram, and a general physical examination and assessment of the patient with regard to her suitability for the anaesthetic and operation All these are essential procedures and will repay the time and trouble taken. In this way, lives are saved, complications are avoided and the patient's convalescence is shortened and relieved of unpleasant symptoms.

Operative difficulties

The technical difficulties of the operation may be considerable, especially if the growth is large or has spread widely A vertical incision heals more easily though some surgeons prefer the better exposure given by a transverse one. Particular care should be taken with large veins or arteries because, in a few cases when these are ligated, the leg becomes gangrenous or the patient has difficulty in walking or running. The collateral circulation is less efficient and adaptable in older patients. The obturator nerve is best left intact though the patient seems to suffer little disability when this is damaged or divided. More serious results, usually fistula formation, follow damage to the bladder wall and, when a growth makes separation of the bladder hazardous, it may be advisable to remove the bladder and transplant the ureters, in which case the patient should have been prepared

for this beforehand. When damage to the bladder or ureter has been accidental, immediate repair should be undertaken as this gives the best results. Damage to the urinary tract, only recognized by leakage of urine later, may be very difficult to treat successfully. A ureteric fistula is probably best dealt with by removal of the kidney, provided that the other kidney is healthy, as transplantation or anastomosis of the ureter is often followed by recurrent infection with all its sequelae. Late repairs of the urinary tract carry an operative mortality of about 10 per cent and often fail to relieve the patient. Pre-operative ureteric catheterization as practised by some surgeons is of doubtful value, except for beginners and nervous operators. The less handling the ureter receives, the less likely is damage to follow. The large proportion of fistulas reported in some series of cases last year, up to 23 per cent, is a disquieting and alarming revelation.

Urinary and rectal disturbances

It must be remembered that in the absence of major damage, some urinary disturbance follows pelvic clearance; residual urine, difficulty in micturition or retention, stress incontinence and inability on the part of the patient to recognize her full bladder. Improvements may be expected to occur during the 3 months following operation, but in many cases the condition becomes chronic after a year. Affected patients may lead reasonably comfortable lives by emptying the bladder at regular intervals.

Damage to the rectum with fistula production is less common but it does occasionally occur when insufficient care has been taken to separate the gut from the back of the uterosacral or cardinal ligaments before dividing them.

Post-operative care

Immediate post-operative care consists of the replacement of blood loss by transfusion, and the treatment of shock by rest and avoidance of heat. The bladder is emptied regularly by catheter, and infection is treated by suitable antibiotics and [illegible]

Treatment by radium

Treatment with radium alone is becoming less popular to-day than in the recent past, except in units staffed by gynaecologists unable to undertake major pelvic clearance operations The improvements in the results of Wertheim hysterectomy have made the results of surgery better than those of radium, though the latter should, of course, still be employed on those patients unfit for operation, either by virtue of their general physique and age or of the nature and spread of the growth. Some patients refuse operation. Glucksmann cell counts should be made in all these cases in order to determine the effect of radium. Appropriate spacing of the radium in the uterus and vagina should not be difficult if modern apparatus is used and advantage taken of the advice of a physicist. The best results in the treatment of carcinoma are, on the whole, shown by cases submitted to Wertheim hysterectomy after preliminary radiation.

One of the difficulties in the past has been a failure to achieve adequate radiation

to the growth on the pelvic wall. The injection of radioactive gold in liquid form, or the insertion of needles containing radioactive gold, may overcome this difficulty.

CARCINOMA OF THE CERVIX IN PREGNANCY

Carcinoma of the cervix is an uncommon occurrence in pregnancy, the maxim incidence reported being approximately 0·05 per cent. Conversely, some 1 per ce of cases of carcinoma of the cervix are detected during pregnancy. The conditio is almost always found in multiparous patients and, as might be expected, th average age (32 years) of these patients is lower than the general average age among the non-pregnant (43 years)

There is no evidence that pregnancy has any influence on the rate or spread of the growth. Some caution needs to be exercised in making the diagnosis as the changes which occur in the cervix during pregnancy may resemble those occurring in carcinoma These changes are: (1) increase in size and number of glands; (2) cellular hyperplasia; (3) stroma vascularity and oedema; (4) cell infiltration; (5) adenomatous hyperplasia; (6) epidermidalization; and (7) basal layer hyperactivity.

Opinion differs as to the best line of treatment, but probably the termination of the pregnancy by abdominal hysterotomy or caesarean section is preferable to any vaginal method, as the growth will be disturbed much less The carcinoma itself is then dealt with in the appropriate manner.

Should a radical hysterectomy be performed immediately after the uterus ha been emptied, the vascularity of the pelvic organs may make the control of haemorrhage difficult either at the time of the operation or later. There is no justification in delaying treatment of the carcinoma because of considerations as to the viability of the foetus.

VAGINAL CYTOLOGY

Desquamated cells from all parts of the genital tract may be found in the vagina By staining them in the appropriate way, they may be recognized when examined by those who have received special training and experience. The appearance of the cells varies with the stages of the menstrual cycle and these changes may be used for the purpose of differentiating abnormalities and irregularities from those of the normal cycle: abnormal cells are found mainly in patients suffering from infection or new growth. For the diagnosis of the latter, it has been found most useful to examine smears from the endocervix. Malignant cells caught in the cervical mucus are more easily detected than in preparations made from the fluid in the posterior fornix or from a surface biopsy of the cervix itself.

CERVICAL EROSION AND OTHER BENIGN CONDITIONS OF THE CERVIX

For many years, gynaecologists have been attacking the cervix by conization, cauterization, trachelorrhaphy and other more or less violent procedures, in an attempt to eliminate so-called chronic cervicitis and cervical erosion. We now

know that, in large measure at least, these conditions are due to the variation in the hormone levels of the body, the nature of which has not yet been elucidated. Many of these conditions tend to undergo spontaneous remission with amelioration of the symptoms which accompany them and as a consequence, fewer patients are being subjected to operative procedures of the cervix.

In some units, it was the custom to refer patients with these cervical lesions to a special cervicitis clinic, and it is interesting to learn that where careful follow-up of these patients has been undertaken, the incidence of carcinoma is found to be no lower than in patients receiving no treatment. There seems to be, therefore, no reason for treating these conditions on the grounds that the chances of carcinoma appearing later are thereby diminished.

ENDOMETRIAL CARCINOMA

Only 20 or 30 years ago this was a comparatively rare condition, being only one-tenth as common as carcinoma of the cervix. To-day, approximately one case of endometrial carcinoma is found for every two cases of carcinoma of the cervix. An attempt has been made to explain this increase by the ageing of the population. This can only be part of the story It is known that carcinoma of the body appears in patients with a late onset of the menopause, with which is associated a pre-existing metropathia, glycosuria and nulliparity, therefore, also, with fibroids. In addition, there seems to be some evidence that an artificial menopause produced by radium may, later, lead to endometrial carcinoma, though it must be remembered that patients treated in this way are already predisposed to its development. As it is largely a post-menopausal condition and because of its associations, it is not surprising that many patients affected by endometrial carcinoma are unfit for major surgery This is unfortunate because the growth does not respond so readily to radium as does carcinoma of the cervix. In the past this may have been due to underdosage or poor distribution of the radium. Better results are now claimed by packing the cavity of the uterus reasonably closely with multiple radium containers, rather than using the older method of radium in tandem

Carcinoma of the body of the uterus may quickly spread into the cervix, where it behaves in a manner similar to primary carcinoma of the cervix, and its surgical treatment is, therefore, by Wertheim hysterectomy Any lesser operation may well leave malignant cells behind and thereby lower the cure rate

Fundal growths may spread to the aortic lymph nodes by way of the lymphatics accompanying the ovarian vessels and these nodes should always be palpated before proceeding to a radical operation. Fortunately, improved surgical methods, antibiotics and blood transfusion have rendered this operation little more dangerous than a total hysterectomy, with a mortality of well under 1 per cent in the major clinics The chief risk is that of the anaesthetic

Investigation of uterine specimens shows that it is common for malignant cells from the body to be present in the fallopian tubes and the pouch of Douglas. As it is impossible to say whether it is these cells which are responsible for recurrence of the growth, it has been suggested that before closing the abdomen a litre or so of normal saline solution, to which a quantity of radioactive colloidal gold has been added, should be placed in the peritoneal cavity.

ENDOMETRIOSIS

The disability caused by this condition in younger patients may be considerable and yet effective treatment has often been unsatisfactory. Now, hope may be brought to those patients, if the results achieved by high oestrogen administration are substantiated. One of the difficulties is the establishment of the diagnosis in cases not submitted to laparotomy, and especially in differentiating the condition from chronic pelvic inflammation and new growth. In making this distinction, the following points should be borne in mind:

(1) The patient complains of a new kind of dysmenorrhoea, often severe

(2) Bearing down ovarian pain and back-ache. There may be painful defaecation especially at the time of the period. On examination, there is a fixity and loss of outline of the pelvic organs generally with adventitious pelvic masses.

(3) Small discrete globular nodules may be felt and seen in the posterior vaginal fornix.

(4) Patients with chronic pelvic inflammation submitted to short-wave diathermy generally improve, whereas those with endometriosis get worse.

If the diagnosis can be reasonably established, then these patients may be given increasing doses of stilboestrol. Commencing with 1 milligram three times a day for 5 days, the dose is increased to 2, 3, 5, 10, 15 and 25 milligrams three times a day for successive 5-day periods This dose of 25 milligrams three times a day is continued for 3 months and is increased to 50, 75 or even 100 milligrams if vaginal bleeding occurs After 3 months of treatment the oestrogens are withdrawn There is no need to cut the dose gradually. The results are reported to be spectacular; pain is abolished, pelvic organs become freed and masses may diminish or even disappear. In some patients a desired pregnancy has followed

The cause of endometriosis is still obscure but it seems to follow some years of orgasmal intercourse in nulliparous patients and is, therefore, particularly associated with the use of contraceptives.

OVARIAN CARCINOMA

This is usually silent in its earliest stages. the symptoms it produces later are due to the involvement of adjacent tissues and organs. It follows that the survival rate must of necessity, be bad. The best results reported are less than 40 per cent for a 5-year survival rate free from obvious residual growth Some of these patients have been saved because the carcinoma occurred in a pre-existing innocent cyst and its removal was, therefore, fortunate. No patient can be considered safe from recurrence as carcinoma of the ovary is particularly liable to recur after a long latent interval.

It has been suggested that primary carcinoma of the ovary should be graded as follows·

Stage 0 —Carcinoma *in situ*

Stage I.—Carcinoma apparently confined to the ovary.

Stage II.—A break through the ovarian capsule but no obvious spread to adjacent tissues

Stage IIa —Carcinoma affecting both ovaries

Stage III.—Pelvic dissemination.

Stage IV.—Distant metastases

Stage IV (L).—Secondary growth in liver.

CHORIONCARCINOMA

Chorioncarcinoma generally follows within a few weeks of the termination of pregnancy, particularly in cases of hydatidiform mole, but occasionally, it is found in women after the menopause or even in male patients. Although having a somewhat similar histological appearance, these latter cases are probably quite different entities from those cases associated with pregnancy and call for different methods of investigation and control.

It seems to be generally accepted to-day that chorioncarcinoma associated with pregnancy is always accompanied by an increasing titre of gonadotrophic hormone in the urine, and that a positive test due to chorioncarcinoma is preceded by a negative phase which may only last 2 or 3 weeks. As the hydatidiform mole is so commonly followed by carcinoma, every case following the expulsion of the mole should be closely watched and gonadotrophic urinary investigations should be made at least every fortnight. Unless this is done, the negative phase will be missed and there must be doubt as to whether a positive test is due to some of the mole still remaining, to the development of a carcinoma, or to pregnancy. Exploration of the uterus in these cases is of little value, although an empty cavity is suggestive of carcinoma, as the growth begins in the wall of the uterus Any material removed should, of course, be submitted to microscopy but the histological picture of both mole and carcinoma may be similar and cannot, therefore, be relied upon for a differential diagnosis. The persistence of gonadotrophin in the urine, perhaps for weeks or even months, following expulsion of the mole, is indicative of incomplete evacuation, and the tests become negative when the cavity is emptied

Chorioncarcinoma is a peculiar condition in that the malignant cells are foreign cells which tend to invade the blood vessels and are spread by this means. The earliest metastatic deposits are to be found as a rule in the lungs where they give rise to opacities on radiography. Similar findings may also accompany hydatidiform mole, but in this case, the deposits disappear when the mole is expelled.

It follows, therefore, that chorioncarcinoma occurs in a particular group of patients at a particular time; it originates in the uterine wall and can be detected immediately by examination of the urine. Immediate hysterectomy, without the necessity of removing the ovaries, gives an excellent result, in spite of the rapidly spreading nature of the tumour. It is disappointing to find that cases are still being reported in which these elementary precautions are not taken, sometimes with fatal results. Many more cases must fail to reach the literature.

POST-MENOPAUSAL BLEEDING

The administration of oestrogens to patients who have ceased to menstruate is probably the commonest cause of post-menopausal bleeding to-day. Some caution should be employed in investigating these patients as the uterus is likely to be thin-walled and the cervix atrophied and easily torn, and the risk of dilatation of the cervix and curettage of the uterus is considerable. In the absence of oestrogen administration it is often best to wait for a second passage of blood to occur before [illegible]

undertaken.

CLINICAL ASPECTS OF NON-OVULATION*

The survival of each species from the distant past is dependent upon the successful function of the reproductive system in each sex. It is a characteristic to which the doctrine of the survival of the fittest must always apply, because the individual with reproductive failure leaves no descendants. In spite of this, functional deficiency in the reproductive system is often encountered to-day. One aspect of it, the failure of ovulation in women, is considered here.

Menstruation may be defined as a discharge of blood and other matter from the uterus in association with ovulation. This discharge, lasting some 5 or 6 days, normally recurs approximately every 28 days, although variations in the frequency, the duration and the amount of the flow are found. The loss of blood is dependent on the breakdown of the endometrium which accompanies the fall in oestrogen and progesterone concentrations in the body following the decay of the corpus luteum. Prolonged and excessive bleeding sometimes occurs when it is due to irregular shedding of the endometrium.

Vaginal bleeding may occur in the absence of a corpus luteum, when it may be due to a fall in oestrogen level alone, though it differs from normal menstruation in certain important details. This kind of bleeding follows changes in a graafian follicle that has failed to rupture, and may conveniently be called non-ovular menstruation although, strictly speaking, it is not menstruation at all

Clinical features of non-ovular menstruation

Non-ovular menstruation is demonstrated by many clinical features, the more general are listed as follows:

(1) The flow is clotted. Normal menstruation is free from clots larger in size than a pin's head, unless it becomes excessive. This is probably the most important diagnostic symptom.

(2) The interval between two periods may be very variable, and is often less than normal

(3) The amount and duration of the flow differs from one period to another. As a rule the longer the interval between two periods the greater will be the quantity lost.

(4) The bleeding may continue, sometimes with occasional flooding, for several weeks.

(5) The period often comes on without warning, and may take the patient by surprise.

(6) The period may be broken into two parts by a clear day, usually near the beginning, and may gradually tail off at the end with several days of brown discharge.

(7) Spasmodic or colicky dysmenorrhoea is absent, unless large clots are passed. Congestive pain may be present, dependent on the cause and type of non-ovular menstruation.

(8) There is often lower abdominal or pelvic pain and discomfort present throughout the whole cycle, with exacerbations or severe or disabling pain at times. This is caused by tender polycystic ovaries, which may also cause dyspareunia.

(9) There is often an associated cervical erosion.

(10) Changes in personality, due to abnormal hormonal balance, accompany non-ovulation. The patient develops an emotional instability and often cries with little cause. She loses her patience with the rest of the family and feels unable to deal with life's many problems. These symptoms may be enhanced if she becomes anaemic with polymenorrhoea and menorrhagia

(11) It sometimes happens that one ovary fails to ovulate, while the other one behaves normally. The pain is then unilateral, and the periods tend to alternate between normal and non-ovular.

Diagnosis of non-ovulation

The ultimate test for non-ovulation is, of course, the finding of persistent graafian follicles in the ovary, together with the absence of the corpus luteum in the second half of the menstrual cycle. This, however, is not often practical, and the failure of ovulation must be deduced from circumstantial evidence.

Premenstrual biopsy.—This reveals a non-luteinized endometrium with the following characteristics: (*a*) thick fleshy strips are removed at the time of the curettage; (*b*) endometrial glands are often dilated and of irregular size and contain clear gelatinous excretion; (*c*) the secretory cells are a single layer thick and there is no corkscrewing or ferning of the glands; (*d*) cellular stroma; (*e*) non-vacuolated columnar cells in the glands with central nuclei Mitotic figures are present; and (*f*) absence of glycogen in the cells and their excretions.

Vaginal smear.—Ovulation is followed by the presence of cornified cells in the vaginal epithelium and discharge, these are absent when ovulation fails to occur. Special staining methods are necessary, and the smear needs considerable skill in its interpretation.

Bimanual pelvic examination.—It is sometimes possible to feel the enlarged, tender cystic ovaries.

Basal body temperature.—A persistent subnormal temperature in the second half of the menstrual cycle with the absence of the sharp rise which normally accompanies ovulation indicates non-ovulation The temperature should be taken per rectum or per vagina, before the patient rises in the morning.

Hormone assay.—There is an absence of pregnanediol in the urine during the second half of the cycle.

Of all these methods probably the most reliable and, therefore, the most valuable, is the premenstrual biopsy, and this is the method most commonly used. As the endometrial changes are not necessarily uniform throughout the body of the uterus a sample of endometrium should be obtained both from the anterior and posterior uterine walls. Signs of progestational activity present in any part of the endometrium indicate ovulation

Technique for obtaining endometrial specimens

In some cases, where dilatation and curettage is part of the treatment, it is unnecessary to obtain a separate biopsy specimen for examination. Care should be taken in timing the operation to take place in the second half of the cycle, preferably within one week of the expected period: this may be missed when the periods are completely irregular. When the endometrium is required for diagnostic purposes only a special biopsy curette, such as Sharman's or a suction curette,

should be used. A suction curettage provides rather thicker strips of endometrium than Sharman's curettage, and several specimens may be obtained with only one introduction of the curette into the uterus. They may be blown out into the preserving solution quite easily. Either curette may be used without an anaesthetic and without preliminary dilatation of the cervix, though apprehensive patients will usually require sedation, such as morphine or pethidine. When vaginal bleeding is irregular or infrequent it is advisable to take a weekly biopsy until the bleeding starts.

Presenting symptom in non-ovulation

This is usually a change in the menstrual rhythm or in the quantity or duration of the menstrual discharge as described above, but it is dependent to some extent on the type of non-ovulation. Pain is generally the leading symptom in the presence of chronic pelvic inflammation, whilst in other patients the discharge of an accompanying cervical erosion may overshadow all else. In the persistent type of non-ovulation there may be no symptoms at all, or the patient may complain of infertility.

Types of non-ovular menstruation

The following is a list of the many types of non-ovular menstruation: non-ovulation of puberty (menorrhagia of puberty); non-ovulation of the menopause (metropathia haemorrhagica, chronic metritis, chronic endometritis, and chronic subinvolution); post-puerperal and post-abortal non-ovulation; non-ovulation associated with fibromyomas, non-ovulation associated with chronic pelvic inflammation; persistent non-ovulation; sporadic non-ovulation; induced non-ovulation; and oestrogen withdrawal bleeding.

Non-ovulation of puberty

The first few periods at the menarche are usually non-ovular in type. As such they are painless, clotted and may be excessive or irregular. No special treatment is required unless the bleeding becomes excessive as ovulation will soon set in. The treatment of the menorrhagia is symptomatic and the bleeding can usually be arrested by the administration of progesterone in doses of 10–20 milligrams

Oestrogens, by preventing further endometrial breakdown, will also stop the bleeding, but they are not so useful as there is some danger of further severe loss as the dose is reduced or stopped.

Curettage for this condition is rarely required, and is to be used only as a last resort in a person so young.

Menopausal non-ovulation

Many women aged between 35 and 50 years suffer from this condition, and it is the commonest complaint to be met with in the gynaecological department. The menorrhagia has all the characteristics of typical non-ovulation, and the bleeding may lead to quite severe degrees of anaemia. At the beginning it is often preceded by a few weeks amenorrhoea, but afterwards there are commonly only two or three weeks between successive periods. At times, therefore, there may be difficulty in differentiating between this condition and pregnancy. Menopausal non-ovulation

is commoner in women who have had children: the uterus in these cases is usually bulky.

Dilatation of the cervix and curettage of the endometrium undertaken premenstrually serve to confirm the diagnosis, and will restore ovulation in perhaps half the cases. A large number of patients fail to benefit or only do so for two or three months, and on these women total hysterectomy should be performed There is some evidence that the condition predisposes to adenocarcinoma of the body of the uterus later in life, and this is especially so when a patient is treated by a radium menopause. Occasionally, a patient may benefit by thyroid administration and it is useful to estimate the basal metabolic rate.

Post-puerperal and post-abortal non-ovulation

Although a subsequent pregnancy may occasionally occur in a patient recently delivered, without an intervening menstrual period, the first few periods following a labour or abortion are, nevertheless, usually non-ovular These non-ovular cycles may persist for months or years, especially after an induced abortion The symptoms are similar to those enumerated above, and as a cervical erosion is probably always present, vaginal discharge may be the chief complaint of the patient. Spontaneous rectification of the cycle is likely to occur sooner or later, but the patient who feels she is unable to await ovulation may usually be restored by dilatating the cervix and curetting the uterus Cauterization of the cervix, though often effective, is probably a less desirable form of treatment.

Non-ovulation associated with fibromyomas

When menorrhagia is due only to subendometrial fibromyomas the interval between the periods remains as before, but the bleeding gradually increases in amount and duration over the months Non-ovular menorrhagia usually complicates fibroids situated anywhere in the uterus, and gives the typical syndrome. The only treatment which will relieve these patients of their symptoms is the removal of the fibroids by myomectomy or hysterectomy Dilatation and curettage is ineffective Fibroids normally delay the onset of the menopause until the patient is well over the age of 50 years, and no natural amelioration of the symptoms is to be expected in younger patients Infertility, common among patients suffering from fibroids, is due to accompanying non-ovulation Removal of the fibroids will usually restore normal menstruation.

Non-ovulation associated with chronic pelvic inflammation

Chronic pelvic inflammation is a condition of fibrosis and adhesion affecting the pelvic organs and tissues following infection, haemorrhage, trauma, new growth or radiation It gives rise to the well-known syndrome of menorrhagia, backache, vaginal discharge, dysmenorrhoea, dyspareunia, pain on defaecation, infertility, and chronic pelvic pain These symptoms are, in part, due to the ovaries being bound down with adhesions, and the mechanical obstruction of these may prevent the rupture of the follicle Non-ovulation is only an incidental result of pelvic damage in these patients who often lead a miserable existence until relieved by the onset of the menopause. When treatment is called for the more moderate cases may benefit by short-wave diathermy or other physiotherapeutical devices Other

patients may need a laparotomy, when adhesions may be divided, the uterus moved forward and the ovaries brought up out of the pelvis. More severe cases require the extirpation of the uterus, fallopian tubes and ovaries.

Persistent non-ovulation

Infertility may well be the only complaint of women suffering from persistent non-ovulation, and a careful history will usually reveal at least some characteristics of this condition. These patients usually have the typical physique. They are of the youthful type, with slender hips and little subcutaneous fat. Axillary and pubic hair is usually scanty and the pubic hair is bunched and does not terminate in a straight line across the lower abdomen. The breasts and nipples are small and underdeveloped. The diagnosis is confirmed by premenstrual biopsy, but there is no satisfactory treatment for this condition at present. Spontaneous cure may follow marriage or other emotional disturbances.

Sporadic non-ovulation

This condition is usually found, accidentally, in patients undergoing investig tions for infertility. Non-ovular cycles may occur singly or several together, an they especially follow intercurrent disease, accidents or changes in environment It may be one sequel of the stress syndrome. These patients have a lowered fertility, and they may at any time become victims of persistent non-ovulation. In the absence of any obvious cause they are better without treatment.

Induced non-ovulation

Married women who have been ovulating and menstruating normally may change to non-ovular cycles should they be submitted to repeated intercourse without reaching an orgasm and without becoming pregnant. Not uncommonly the condition follows a few years after marriage in which contraceptives have been continuously employed It is also particularly associated with coitus interruptus After childbirth the emotional disturbances accompanying non-ovulation of this type are often particularly marked.

ECTOPIC GESTATION

A common cause for this condition appears to be a failure or partial failure of the current down the tube into the uterus following damage of the ciliated epithelium This damage consists of the loss of the epithelium together with the destruction of the plicae. Absent or abnormal peristalsis of the tubal muscle is unlikely to be a cause. It follows that ectopic pregnancy is to be expected in patients who have previously suffered from a mild degree of salpingitis. A severe degree of salpingitis leads to permanent blocking of the tube. As recovery from mild salpingitis takes place, the lumen of the tube becomes re-established and the flow is restored to a greater or lesser extent. A rate of flow of less than half normal is probably necessary before a tubal pregnancy occurs Congenital abnormalities of the tube are responsible for a few cases of ectopic gestation. It is uncertain to what extent the presence of ectopic endometrium in the tube can be held responsible. In about 10 per cent of cases the corpus luteum is found in the contra-lateral ovary of the affected tube

There is little difficulty in the diagnosis of an acute rupture with severe intraperitoneal haemorrhage. A subacute case, however, may present great difficulties. The majority of patients complain of pain or bleeding, or pain and bleeding, but the manifestations are protean and no symptom or sign can be relied upon.

Haemorrhage from a ruptured follicle presents difficulty in differential diagnosis, and it is often advisable to admit a doubtful case to hospital for observation when the final diagnosis in due course becomes obvious.

PRIMARY DYSMENORRHOEA

This is usually associated with ovulation and is characterized by a typical colicky uterine pain occurring during the first day of menstruation (primary spasmodic dysmenorrhoea). Its severity is very much dependent upon the environment: when investigating a case attention should be paid to the attitude of the mother, the mental equilibrium and intelligence of the patient, the satisfactory nature of her employment and her general physique.

Particular note should be made of constipation. This is a common symptom of the premenstrual state and is associated with the high progesterone levels present at that time. Prevention of constipation alone may be enough to relieve the patient.

Where the correction of the environment and the education of the patient still leave the patient with severe dysmenorrhoea, then the production of a series of non-ovular cycles (at least three) by the regular administration of oestrogens may be sufficient to effect a cure If the dysmenorrhoea comes back with the return of ovulation, the choice of treatment lies between the further administration of oestrogens or the adoption of the usual operative procedures, especially that of cervical dilatation. In cases unrelieved by non-ovulation, the disability may be assumed to be psychological and no form of local treatment can be expected to minimize the pain Care must be taken, in these cases, to differentiate primary spasmodic dysmenorrhoea from pain associated with non-ovular cycles as this will be unrelieved by oestrogens; indeed, the condition may be made worse

The pain accompanying the latter type of dysmenorrhoea tends to be bearing [illegible]

Still further confusion may result because the passage of clots accompanying non-ovular menstruation may be associated with colicky contractions of the uterus In cases of doubt, further investigations may be advisable to differentiate the two types of cycle.

There is no satisfactory treatment for the relief of non-ovular dysmenorrhoea, but some patients benefit from a dilatation and curettage. Dysmenorrhoea tends to improve or disappear with age, marriage, or the bearing of children. Radical procedures such as prelumbar sympathectomy are rarely required.

TUBERCULOSIS OF THE ENDOMETRIUM

A national investigation into the treatment of endometrial tuberculosis has been undertaken over the last few years. No patient who was found to have any type

ABNORMAL PRESENTATION

A number of papers on the results of delivery when the foetus presented abnormally, appeared during 1956. Without exception, the foetal mortality rate was higher than those delivered by the vertex. Breech, face and brow presentations were those mainly considered.

Methods and technique for delivery varied. It was suggested that caesarean section should be considered as the most suitable method for delivering all these cases as little or nothing is added to the maternal risk. However, the late complications of caesarean section, namely, lowered fertility, rupture of the scar, and abdominal adhesions, were not taken into account, and in Great Britain, where traditional methods of treatment are favoured, the suggestion would probably not meet with approval. It is clear, however, that an accurate knowledge of the shape and size of the pelvis, together with the exact position and attitude of the foetus, should be known in every patient on whom a vaginal delivery of a malpresentation is contemplated, together with any other relevant facts, and all deliveries should be conducted or closely supervised by someone of high technical ability and considerable experience in this type of labour To a certain degree, foetal mortality is related to the size of the baby and prematurity is a common cause of death At the other end of the scale, a large foetus will add to the difficulties of delivery and is therefore less likely to survive. Conservatism should be practised during pregnancy when the baby is small, and labour should be induced by an appropriate method if it is estimated that the foetus has reached a weight of 7 pounds

Caesarean section should, of course, be avoided in cases of gross congenital abnormality or intra-uterine death of the foetus The prevention of an abnormal presentation during labour by constant antenatal care still remains the best line of treatment.

RUPTURE OF THE GRAVID UTERUS

Rupture of the gravid uterus is nearly always due in some way to a failure of obstetric skill. The grave risk of a ruptured uterus which follows a previous classical caesarean section can easily be prevented by an avoidance of this particular operation which should not be performed to-day The rupture of a lower segment scar may occur during labour and is due to incorrect apposition of the incised edges of the uterus at the time of the previous operation. It is particularly noticeable that these ruptured scars are infrequent amongst patients operated upon in well-organized units. Other cases of rupture are due to poor judgment and technique during obstetric operations, such as the premature application of obstetric forceps or the performance of internal version. It is surprising that cases of rupture of the uterus following the administration of comparatively large doses of ocytocic drugs during the first or second stages of labour often occur to-day. Occasionally, a blameless rupture does occur, perhaps in a multipara or in association with an unstable pregnancy Ruptured uterus is accompanied by a high mortality rate—up to 5 per cent Many of these deaths are due to a failure to recognize the condition when it first occurs, and it is safe to say that the longer the interval between the rupture of the uterus and the application of appropriate treatment, the greater will

be the hazard to the mother. Classically the symptoms and signs are severe continuous abdominal pain, shock, vaginal haemorrhage, cessation of uterine contractions, disappearance of foetal heart sounds and the presence of fluid in the abdomen; any or all of these signs may or may not be present. Whenever the character of a labour changes from the pattern already established, the possibility of a rupture of the uterus should be borne in mind. The treatment will usually consist of hysterectomy, though in an occasional case conservation of the uterus and repair of the rupture may be justifiable.

ABSTRACTS RELATING TO GYNAECOLOGY AND OBSTETRICS

Carcinoma of the cervix

Current trends in diagnosis and treatment

Carcinoma of the cervix is discussed by MEIGS (1956b). The increasing interest in this lesion in the last decade is largely due to the introduction of the vaginal smear, the greater [illegible] of [illegible] procedures and the selection of patients. The use of the sensitization [illegible] Graham to deter- [illegible] added interest. [illegible]

small radiation doses before [illegible] were cured by post-operative vaginal x-rays. Conversely, some radiation failures were [illegible] radiation [illegible]

[illegible] far from clear. Invasive cancer, however, appears to be decreasing, although a very few cases, even if diagnosed early, do not respond to treatment.

Treatment

VAN BOUWDIJK BASTIAANSE (1956) discusses cancer of the cervix uteri. Primary mor- [illegible] permanent recovery [illegible] other x-rays signi- [illegible] ing from radio- [illegible] Surgical damage [illegible] All methods of [illegible] node dissection is [illegible] too widespread [illegible]

cent of patients. Its disadvantages are increased risks in operation, ureteral necrosis and implantation metastasis without pre-operative radium therapy. Lymphadenectomy is more difficult and the operation therefore less radical with pre-operative radium. In Schauta's operation the operative hazard is less, there is no ureteric necrosis, and pre-operative radium hardly affects surgery. On the other hand, regional lymph nodes cannot be removed and bladder function may be impaired. Extraperitoneal lymphadenectomy seems to offer no advantage over transperitoneal excision of the nodes. Treatment in

and Wertheim's operations are described in full.

Hysterectomy

Analysis of results in benign pelvic disease

JOHNSON, MOLL and POST (1956) analysed 6,891 hysterectomies for benign pelvic disease. Hysterectomy is perhaps the safest of the major abdominal operations, but only successful as Miller stated in 1932 "when it is performed upon the proper indications". For

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incidence in this series being 31 per cent in Negro women and 15 per cent in white women. Pelvic inflammatory disease including tubo-ovarian abscess is another indication in which early surgical treatment is essential In 19 of 116 cases of tubo-ovarian abscess, rupture had occurred. The mortality rate, formerly assessed at 90 per cent, has been reduced to between 15 and 20 per cent. Total hysterectomy is performed in both ruptured and

unsatisfactory effect of retention of the cervix after the subtotal operation, with its

Fallopian tubes

Plastic operations

The present status of plastic operations on the fallopian tubes is discussed by GREENHILL (1956). In 1936, in a very pessimistic article, he reviewed the poor results of 818 such

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ABSTRACTS RELATING TO GYNAECOLOGY AND OBSTETRICS

Carcinoma of the cervix

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Treatment

VAN BOUWDIJK BASTIAANSE (1956) discusses cancer of the cervix uteri. Primary mortality by all methods of treatment has become almost negligible, but permanent recovery depends upon local recurrence or metastasis. Recurrence following radium therapy is due to resistance to irradiation, the inaccessibility of some cancer cells, and the appearance [illegible] is due to incomplete surgery or the [illegible] therapy ranges from proctitis or [illegible] includes impairment of the bladder [illegible] of cancer in situ lymph node dissection is [illegible] cancer, too widespread [illegible] other cases should receive [illegible] 's operation is difficult. [illegible] a possible benefit to 4 per [illegible]

ent of patients. Its disadvantages are increased risks in operation, ureteral necrosis and implantation metastasis without pre-operative radium therapy. Lymphadenectomy s more difficult and the operation therefore less radical with pre-operative radium. In Schauta's operation the operative hazard is less, there is no ureteric necrosis, and pre-operative radium hardly affects surgery. On the other hand, regional lymph nodes cannot be removed and bladder function may be impaired. Extraperitoneal lymphadenectomy seems to offer no advantage over transperitoneal excision of the nodes. Treatment in Stage I and Stage II is a full dose of radium followed, 4 weeks later, by Wertheim's or Schauta's operation and x-ray if necessary; in patients aged under 35 years, the ovaries are not removed and no post-operative irradiation is given. In Stage III, 4 weeks after

[illegible]

and Wertheim's operations are described in full

Hysterectomy

Analysis of results in benign pelvic disease

JOHNSON, MOLL and POST (1956) analysed 6,891 hysterectomies for benign pelvic disease. Hysterectomy is perhaps the safest of the major abdominal operations, but only successful as Miller stated in 1932 "when it is performed upon the proper indications". For 25 years there has been an increasing tendency towards total and away from subtotal hysterectomy. Vaginal hysterectomy, meanwhile, has been more frequently practised, particularly upon Negro patients It should be selective and in no way competitive with

[illegible]

between 15 and 20 per cent. Total hysterectomy is performed in both ruptured and unruptured cases; these cases were selected, however, on the basis of the patient's general condition Tubal pregnancy constitutes a further indication for operation as does any

[illegible]

Fallopian tubes

Plastic operations

The present status of plastic operations on the fallopian tubes is discussed by GREENHILL (1956) In 1936, in a very pessimistic article, he reviewed the poor results of 818 such

operations. From more recent literature and from surgeons specializing in the procedure, fresh data were obtained. Following 2,113 plastic tubal operations, there were 405 pregnancies or 1 after every 5 operations. Fewer than 313 live infants were born, however, or 1 for every 6¾ operations. The incidence of ectopic gestation was 15·7 per cent, or 1 after every 6 operations. Siegler and Hellman, in whose survey the incidence was 9·1 per cent, stated that there was no definite proof that tubal surgery predisposed to subsequent tubal

Rubin tests and a hysterosalpingogram should be made; these, however, are not infallable. The following conditions should also be present: the patient must be of child-

... ver, non-surgical therapy of various kinds has ... r. It would seem, therefore, that the surgeons,

Pelvic surgery

Haemorrhage

HOLLENBECK (1956) discusses haemorrhage in pelvic surgery. In operations on the cervix, deep figure-of-eight sutures used in excess or tied too tightly result in necrosis and haemorrhage. In tracheloplasty, the fewer and finer the sutures the better the result. In electrosurgical treatment of the cervix, a cutting current with moderate coagulating qualities to minimize destruction, is recommended. The greatest factor, however, in ... of the peritoneum: this brings all bleeding points ... is not ... ectomy ... should ... and the ... ctomy; ... defect ... omec- ... emor- ... are of ... ation. ... s best ... ediate ... several hours after surgery, responds to blood transfusion and then recurs, ... suggests concealed haemorrhage. Laparotomy should immediately be performed, even in the absence of signs of intra-abdominal fluid. *In all cases of shock, blood replacement must take priority over other procedures.* The possibility of blood dyscrasias, particularly thrombocytopenia, must be remembered.

Menstruation

Irregular shedding of the endometrium

... irregular shedding of the endometrium. ... prolonged and ... out of a total of 152 patients

helpful in about half of the typical cases but only in one-third of the atypical cases

possibly caused by abnormal endometrial response to normal progesterone levels Post-ovulatory stilboestrol therapy was effective haemostatically but did not shorten the length of the bleeding period

Placenta

Anatomy of the villus

CRAWFORD (1956) describes the anatomy of the villus and its capillary structure The placental capillaries, in life, are closely enmeshed and difficult to examine; the method employed is explained Forming the "fringe" of the cotyledon, the capillaries vary greatly in size, number and complexity. The proximal vessels given off by the parent arteriole and

more complex the capillary loop, therefore, the more numerous the projections. the

the decidua less under the chorion least within the cot ledon and must be related to th

vascular shunt excluding blood from the foetal villus.

Anatomy of cotyledons

The anatomy of the cotyledo

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branches from the main superficial chorionic vessels, and by vessels derived from the cotyledonary vessels before or after the primary division. Three sizes are thus produced. The large cot ledon extend to th

They interdigitate with each other and with subcotyledons of related cotyledons, making a functional whole. Although never reaching the decidua, many adhere to the chorion. In life, the placenta is filled with vessels of the cotyledons, the smaller bearing villi being found at the periphery. Although the small cotyledons far outnumber the large, the latter occupy most of the placental space. In each of these, one subcotyledon, by firmly attaching itself to the decidua, produces in the cotyledon an area of particularly intimate placental fixation. The vessels concerned with fixation, particularly the peripheral villi, end in the decidua, their function appearing to have become entirely mechanical.

Pre-eclampsia and eclampsia

Aetiology

DIECKMANN and POTTINGER (1956) discuss the aetiology of pre-eclampsia-eclampsia. The causes of this condition most frequently presented are water intoxication and "salt" poisoning, the former showing an excess of water, the latter of electrolyte. In the past 15 years it has been shown that sodium is not only extracellular but can enter muscle and other cells causing, if its increase is sufficient, marked disorganization. Furthermore, an excess or depletion of sodium, potassium, chloride, water and possibly other ions occurring both intracellularly and extracellularly, will result in clinical manifestations which are sometimes of such severity as to cause death. In this study comparisons were made between pieces of the rectus muscle and abdominal skin obtained from (1) non-pregnant and normal pregnant women; (2) normal pregnant women and those with pre-eclampsia and hypertensive disease, and (3) patients with pre-eclampsia and hypertensive disease. In the normal pregnant patient, compared with the non-pregnant, the muscle changes were as follows: unchanged water content; increase in sodium; no change in potassium, increase in the Na : K ratio, no change in the nitrogen content. In the skin, sodium and water were increased, potassium and the Na : K ratio were unchanged; and nitrogen was slightly lower in wet tissue. In pre-eclampsia or hypertensive disease, as compared with normal pregnancy, the muscle changes were: unchanged water content; decrease in sodium (similar to non-pregnancy values), unchanged potassium and nitrogen. The Na : K ratio was less in pre-eclampsia than in hypertensive disease. In the skin, water, potassium, and the Na : K ratio were unchanged, sodium was decreased. Nitrogen in wet tissue was higher from the hypertensive patient than from the normal pregnant or pre-eclamptic patient. These significant results, at variance with published reports, were surprising to the authors, who expected to find an increased water content in the rectus muscle of pre-eclamptic patients, a slight increase of sodium in normal pregnancy and a marked increase in pre-eclampsia. This study indicates, however, that in pre-eclampsia and hypertensive disease there is a marked decrease in the sodium ion concentration of voluntary muscle with a resulting alteration in the Na : K ratio, the values being essentially those of non-pregnancy.

Toxaemia of pregnancy

ABO blood groups

DICKINS and his colleagues (1956) present further observations on ABO blood-group frequencies and toxaemia of pregnancy. In 1954 in a comparison made in 3,651 deliveries, Pike and Dickins noted that toxaemic mothers showed a higher frequency of group O than the others, but stricter criteria for the diagnosis of toxaemia appeared to be indicated. Ninety-three women were therefore transferred from the toxaemic to the non-toxaemic group, on the grounds that arterial pressure had reached 140/90 in labour only; that the prescribed level of arterial pressure was attained by either systolic or diastolic reading and not by both, and that the history of toxaemia in a previous pregnancy was not established beyond doubt. However, the modified figures did not refute the evidence. Analysis of a second and later series from the same hospital failed to confirm the original result and there is therefore no irrefutable evidence that toxaemic and non-toxaemic mothers differ in their ABO frequencies. No reasons can be found for the discrepancy in the two periods. When there was thought to be an excess of group O in toxaemia the question of ABO

heterospecific pregnancy was re-examined, but it afforded no satisfactory explanation. That the first period yielded a significant excess of group O in toxaemia, while the second yielded no such excess, unless explained by some phenomenon, can only be attributed to chance. Further investigations therefore are necessary, and comparisons with results from other hospitals in other areas desirable.

Antigen-antibody reaction.—PEARSON and PINKER (1956) discuss ABO blood groups

Diabetes mellitus and pregnancy

Perinatal deaths

HAGBARD (1956) reviews the perinatal deaths in 2 series of diabetic pregnancies In

uterine deaths are attributable to the mother's diabetes *per se*, however, when the preg-

Foetal aspects

The child in diabetic pregnancies is discussed by HAGBARD (1956). Although the higher birthweight is attributed partly to a greater amount of fat and a greater tendency to oedema, many observers have noted that the bones and viscera are larger than normal, so part is apparently due to actual overgrowth; the most recent theory ascribes the oversize to excessive production of hormones from the anterior pituitary lobe. There are varied opinions as to whether foetal malformations are more common in diabetic than in other pregnancies. An analysis of the data from the literature relating to the incidence of stillbirth and neonatal death and total foetal mortality in diabetic pregnancies shows that 25–50 per cent of the babies still die in some places. Hormonal treatment of diabetic pregnancies appears to be of doubtful value; probably the good results that have been obtained were due to factors in the regime such as strict supervision throughout the pregnancy, long hospitalization, attention to complications, and teamwork. The realization that many babies die *in utero* towards the end of gestation, and that the delivery is frequently made dangerous by an oversize foetus, has led to the conclusion that many of these pregnancies should not be allowed to go to term. There are, however, widely different opinions as to deciding on the time for interruption: some investigators act mainly according to the severity of the diabetes, the age of the patient at onset, its duration, and the presence or absence of vascular damage. Others attempt to calculate the foetal weight by palpation, radiography, and study of the obstetric history, and endeavour to deliver the patient when it reaches a size of about 3,500 grammes. There is a growing opinion, with regard to the mode of delivery, that while caesarean section should not be used as a routine, it should be used for more than purely obstetric indications.

Maternal aspects

The mother in diabetic pregnancies is discussed by HAGBARD (1956). Pregnancy itself upsets the carbohydrate balance of the prospective mother, and also frequently leads to conditions which disturb the carbohydrate metabolism in other ways, such as hyperemesis, excessive appetite, great muscular activity and restricted food intake during prolonged labour. Although it is uncertain whether the insulin produced by the foetal pancreas and the carbohydrate consumed by the foetus affect the mother's diabetic state during pregnancy, clinical experience indicates that they do not. There are several facts indicating the diabetogenic effect of pregnancy. One observer who studied 6 enzygotic pairs of twins found that the twin who became pregnant sooner than her sister, or had been pregnant more often, got diabetes earlier than her respective twin. Impairment in the mother's diabetic state in the latter half of pregnancy is attributed to the diabetogenic effect of pregnancy. A review of the factors that might influence carbohydrate metabolism shows how much carbohydrate tolerance and insulin need may vary, the difficulty which may be experienced in balancing the diabetes, and how easily complications like acidosis, diabetic precoma or coma, or hypoglycaemia may develop. A study of the literature indicates that toxaemia occurs much more often in diabetic pregnancies than in others. Reports on the incidence of hydramnios vary, although the amniotic fluid has been shown to contain more than the normal amount of sugar in diabetic pregnancies, no correlation between the sugar content and the amount of amniotic fluid has been found. Although diabetic pregnancies are more often complicated than others, the risk of the mother dying during pregnancy or delivery is now only slight. Those women who die from diabetic coma are usually ones who have had no supervision or treatment, or who have previously had an undiagnosed diabetes and were admitted to hospital in diabetic coma. The deaths due to pre-eclampsia and eclampsia, also, can frequently be attributed to inadequate care.

Rh-sensitized patient

Management

TABLER (1956) discusses the management of the Rh-sensitized patient. Apprehension and Rh negativity appear to go hand in hand, thanks to the medical education freely given in lay magazines and to the misinformation given by nurses among the patient's

acquaintance. She is frightened and confused, attributing miscarriages, difficult labours and obstetrical complications to Rh She gives negativity as a reason for not having children and occasionally pleads it in a request for therapeutic abortion. When the Rh

infants and whose husbands are homozygous is complicated by the problem of foetal death *in utero*.

Intravenous pitocin

Use in obstetrics

WILLIAMS and MCMAHON (1956) review intravenous pitocin infusion in obstetrics, extending its use to multiparae and to selected cases of haemorrhage in pregnancy and labour. This series of 210 patients included 100 multiparae. Adequate cephalopelvic ratio was assured After sedation, a 1: 1,000 infusion of pitocin was begun and continued until the end of the third stage. Foetal heart sounds, blood pressure and uterine contractions were checked. In the 91 patients induced by pitocin, 23 of whom were primiparae, results were uniformly satisfactory. To ensure successful induction, the cervix must be practically effaced and dilated to not less than 2 centimetres, the presenting part must be engaged or easily pressed into the pelvis, the patient must be at, or near, term. Pitocin hastens rupture of the membranes In 9 patients, it was administered to ripen the

retically contra-indicated in placenta praevia, pitocin can be used in selected cases in

of persistent occipito-transverse presentations, the average time for spontaneous rotation to delivery was 25 minutes. There were no foetal or maternal deaths.

Caesarean section

Mortality

twc
blo

and rupture of the uterus accounted for 25 deaths, while errors in treatment accounted for the remainder. Preventable factors included inadequate pre-operative preparation, errors in operative technique and insufficient blood replacement. Deaths from infection were reduced from 21 to 4 during 1945–53. In this period also there was a marked decrease in mortality from haemorrhage, infection and heart disease, but an increase from anaesthesia and embolism. Anaesthesia was responsible for 6 deaths in the earlier period and 11 in the later. Aspiration of gastric contents during inhalation proved fatal chiefly in emergency [illegible] the infant, is only safe for the mother wh[illegible]t heart disease alone does not indicate ca[illegible]pective periods from 10 to 3; operation in these 3 patients was primarily performed for obstetrical reasons. The increased mortality from embolism during the second period could only be explained by the increase in the number of births with consequently more caesarean sections. Early diagnosis and treatment are therefore essential. Death from lower nephron nephrosis occurred when blood banks became generally available. Overenthusiastic and promiscuous transfusions after improper typing of blood caused severe reactions and, in this series, 7 deaths. Renal damage associated with premature separation of the placenta and placenta praevia accounted for 3 more. Toxaemia persisting after termination of pregnancy and co-existing medical disease, where caesarean section was only undertaken to obtain a live infant, were other causes of death.

Transvaginal pudendal-nerve block

Improved approach

WILDS (1956) presents an improved approach to transvaginal pudendal-nerve block. Anatomically, the perineum is innervated by the ilioinguinal, the posterior femoral cutaneous and the internal pudendal nerves. Since the first two, however, rarely extend into the female perineum, they do not require separate block, complete anaesthesia of the perineum, with relaxation of the pelvic floor, being achieved by blocking the main internal pudendal trunk. A syringe containing 10 millilitres of anaesthetic solution is introduced into the vagina and the needle advanced to enter the mucosa overlying the sacrospinous ligament, just posterior and medial to the tip of the ischial spine. The ligament is infiltrated with 2 or 3 millilitres of the solution, the remainder is deposited below it. The procedure is repeated on the opposite side. This technique ensures control of the depth of injection, anaesthetization of the ligament and blocking of the aberrant inferior haemor-[illegible] from the initial injection in 84 per [illegible]veral anaesthetic solutions used [illegible] of anaesthesia. The most satis-[illegible]n, which produced a rapid onset [illegible] (Xylocaine) gave almost as good [illegible]either routine premedication nor sedation was given. Antibiotics were not used and only one case of infection occurred. The outstanding advantage of the transvaginal approach is its ease of administration. Its greatest disadvantage is the occasional difficulty in identifying the sacrospinous ligaments which, in multiparae at term, are so thin as to offer practically no resistance to the [illegible] least painful method of providing perineal and vaginal anaesthesia, [illegible] however, requires additional anaesthesia.

Diagnosis of foetal sex

Analysis of amniotic fluid cells

[illegible] cells for diagnosis [illegible] and pre-[illegible] foetus.

the percentage of cells with a chromocentre at the nuclear margin gives no less a sex difference than one based on the percentage of cells with a chromocentre at any position in the nucleus, the former analysis is easier and is recommended. In the 47 cases, there was a mean of 4 per cent of cells with a chromocentre at the nuclear centre in males and 35 per cent of such cells in females; the chromocentre was also larger in the females. A mean of 12 per cent of cells suitable for diagnosis was found in the sixth, seventh and ninth month cases; in the third month case, 61 per cent of cells were suitable.

Pulmonary hyaline membrane syndrome

Pathogenesis

Role of oxygen and amniotic fluid—LAUFE and STEVENSON (1956) discuss some effects of oxygen and amniotic fluid in the pathogenesis of the pulmonary hyaline membrane syndrome In 1954 the authors produced in experimental animals, by means of intra-

and the concurrent production of a pulmonary exudate, of varied aetiology, a new series of experiments was carried out, in which exposures to high-oxygen environments were

production which was associated with atelectasis, reduced levels of oxygen were also investigated A study was made of 151 guinea-pigs and 75 control guinea-pigs; the animals were divided into 6 groups, which were exposed to different concentrations of oxygen Two additional groups of animals were given intratracheal injections of physiological

oxygen environment may perpetuate the effusion.

BIBLIOGRAPHY AND REFERENCES

Anderson, W. J. R. (1956). "Stillbirth and Neonatal Mortality in Twin Pregnancy". *J. Obstet. Gynaec., Brit. Emp.*, 63, 205.

Anz, U. E., and Smith, L. J. (1956). "Chlorpromazine in Management of Labor". *Amer. J. Obstet. Gynec.*, 71, 1242.

Arneson, A. N. [illegible] and Gynecology in the Treatment [illegible]

Bamforth, J. (19[illegible] *ogy in the Diagnosis of* [illegible]

— (19[illegible] and its Relationship to Endometrial Hyperplasia". *J. Obstet. Gynaec., Brit. Emp.*, 63, 415.

Bayly, M. A., and Greene, R. R. (1956). "Ovarian Tumors and Abnormal Uterine Bleeding". *Amer. J. Obstet. Gynec.*, 72, 143.

Beacham, W. D., Webster, H. D., and Beacham, D. W. (1956). "Etopic Pregnancy at New Orleans Charity Hospital". *Amer. J. Obstet. Gynec.* 72, 830.

Beecham, C. T. (1956). "Surgery for Cervical Carcinoma". *Obstet. Gynec.*, 8, 482.

Behringer, F. R. (1956) "Cervical and Perineal Lacerations. Studies on the Mechanics of Labor in Relation to Cervix, Vulva and Perineum" *Obstet. Gynec.*, 7, 557.

Bishop, E. H. (1956) *Amer. J Obstet. Gynec.*, 71, 1194

van Bouwdijk Bastiaanse, M. A. (1956) *Amer. J. Obstet. Gynec.*, 72, 100.

Brudenell, J. M. (1956). "The Value of Cytology in the Early Diagnosis of Carcinoma of Cervix". *J. Obstet. Gynaec., Brit. Emp*, 63, 380

Brunschwig, A., and Daniel, W (1956). "Pelvic Exenterations for Advanced Carcinoma of the Vulva". *Amer. J. Obstet. Gynec*, 72, 489.

— — (1956). "Evaluation of Pelvic Exenteration for Advanced Cancer of the Cervix". *Surg Gynec. Obstet*, 103, 337.

— Frick, H. C. (1956). "Urinary Tract Fistulas Following Radical Surgical Treatment of Carcinoma of the Cervix (exclusive of Exenterations)". *Amer. J. Obstet. Gynec.*, 72, 479.

Burkons, H. F. (1956) "Ruptured Uterus". Obstet. Gynec., 7, 675.

Buxton, C. L., and Southam, Anna (1956). "Ovarian Dysfunction as an Infertility Problem". *Obstet Gynec*, 8, 135.

Calman, R. M (1956) "Antiseptics in Midwifery". *Brit med J.*, 2, 200.

Carter, B., Cuyler, W. K., Kaufmann, Louise A., Thomas, W. L., Cresdick, R. N., Parker, R. T, Peete, C. H., Jnr, and Charny, W. B (1956). "Clinical Problems in Stage O Cancer of Cervix". *Amer J. Obstet Gynec*, 71, 634.

Christensen, A, and Lange, P. (1956) "Urological and Other Complications Following Radical Hysterectomy for Cancer of the Cervix with Pelvic Lymphadenectomy". *Urol. Int.*, 2, 180.

Clemetson, C A. B. (1956) "The Difference in the Birth Weight of Human Twins". *J. Obstet. Gynaec., Brit. Emp.*, 63, 1.

Collins, J. H. (1956) "Surgery for Carcinoma of the Vulva". *Amer. J. Surg.*, 92, 37.

Commonis, A. C. (1956) "Thyroid Function and Therapy in Reproductive Disturbances". *Obstet. Gynec.*, 7, 260.

Cooke, W. R (1956) "Massive Stilbestrol Therapy of Endometriosis". *Amer. J. Obstet. Gynec.*, 71, 569.

Counseller, V. S., and Haigler, F. H., Jnr (1956) "Management of Urinary-vaginal Fistula in 253 Cases". *Amer. J. Obstet Gynec.*, 72, 367.

Crawford, E. J., Jnr., Robinson, L. S, and Hornbuckle, L. (1956). "Surgery as an Adjunct to Irradiation Therapy in Carcinoma of the Cervix" *Amer. J. Obstet. Gynec*, 72, 125

[illegible] *Brit Emp*, 63, 542.

[illegible] s Due to Placenta Percreta".

Dahle, T. (1956). "Transtubal Spread of Tumor Cells in Carcinoma of the Body of the Uterus". *Surg. Gynec. Obstet.*, **103**, 332.

Davis, B. A., Latour, J. P. A., and Philpott, N. W. (1956). "Primary Carcinoma of the Ovary". *Surg. Gynec. Obstet.*, **102**, 565.

Dearing, Ruth, and Liu, Winifred (1956). "Vaginal Cytology in Cancer of the Cervix". *J. Obstet. Gynaec, Brit. Emp.*, **63**, 375.

Dickins, A. M., Richardson, J R. E., Pike, L. A., and Fraser Roberts, J. A. (1956). *Brit. med. J.*, **1**, 776.

Diddle, A. W., Davis, M., O'Connor, K. A., and Brown, Betty (1956). "Importance of Nutrition in the Irradiation Treatment of Cervical Carcinoma". *Amer. J. Obstet. Gynec.*, **71**, 768.

Dieckmann, W. J, and Pottinger, R. E. (1956). *Amer. J. Obstet. Gynec.*, **71**, 596.

Donnelly, M. M. (1956) "The Influence of Multiple Births on Perinatal Loss". *Amer. J. Obstet. Gynec.*, **72**, 998.

Dugger, J. H., Kegel, E. E., and Buckley, J. J. (1956). "Transvaginal Pudendal Nerve Block—the Safe Anesthesia in Obstetrics". *Obstet. Gynec.*, **8**, 393.

Dumoulin, J. G, and Steed, G. R. (1956). "Bacteraemia as a Cause of Obstetric Shock". *J. Obstet. Gynaec, Brit. Emp.*, **63**, 739

Eichner, E. (1956). "Multiple Carcinoma In Situ". *Obstet. Gynec.*, 8, 508

Erick [illegible]

Evere [illegible] *Gynec*, **72**, 712.

Fallas, R. E. (1956) "Endometriosis Demonstration for the Sampson Theory by a Human Anomaly" *Amer. J Obstet Gynec*, **72**, 557

Fara, F. J., Steward, M., Jnr, and Standard, J. (1956). "The Use of Unlimited Non-sterile Vaginal Examinations in the Conduct of Labor". *Amer. J. Obstet. Gynec.*, **72**, 1.

Fennell, R H (1956). "Carcinoma *In Situ* of the Uterine Cervix". *Cancer*, **9**, 374.

Foraker, A. G., and Reagan, J. W. (1956). "Atypical Hyperplasia of the Cervix Uteri". *Cancer*, **9**, 470.

Fricke, R E., and Decker, D G (1956). "The Intensive Divided-dose Irradiation Therapy of Carcinoma of the Uterine Cervix Rationale and Late Results". *Amer. J. Roentgenol*, **75**, 502

Friedman, E A. (1956) "Cervimetry An Objective Method for the Study of Cervical Dilatation in Labor". *Amer. J. Obstet Gynec*, **71**, 1189.

Gadd, R L. (1956). "Chorionepithelioma. A Report of a Case with Unusual Features". *J Obstet Gynaec., Brit, Emp*, **63**, 564

[illegible] Consecutive [illegible] pus". *New.* [illegible] in Cancer [illegible]

— (1956). *Ibid*, 35, 23.

— (1956) *Ibid*, 35, 85.

Hall, J. E, and Kohl, S (1956) "Breech Presentation" *Amer. J. Obstet. Gynec.*, **72**, 977.

— Counselman, R, and Brooks, J. (1956). "Breech Presentation". *Obstet. Gynec.*, **7**, 277

Harer, W. B (1956) [illegible]

Haskins, A. L., and [illegible] rhea for the Tre [illegible]

Hayden, G E (1956 [illegible] *Obstet. Gynec.*, **71**, 780

Hecht, E. L. (1956). "The Endometrial Aspiration Smear: Research Status and Clinical Value". *Amer. J. Obstet. Gynec.*, 71, 819.

Higgins, L. G. (1957 ... 18.

Hollenbeck, Z. J. R.

Homer, R. D. (1956 ... and Pelvic Lymphadenectomy"

Hunt, H. B. (1956). "Comparative Radiotherapeutic Results in Carcinoma of the Endometrium as Modified by Prior Surgery and Post-irradiation Hysterosalpingo-oophorectomy". *Radiology*, 66, 653.

Hurtig, A. (1956). "Dilatation of the Cervix Uteri". *J. Obstet. Gynaec., Brit. Emp.*, 63, 725.

Israel, S L., and Weber, L. L. (1956) "Postmenopausal Uterine Bleeding". *Obstet. Gynec.*, 7, 286.

Johnson, C. G., Moll, C. F., Jnr., and Post, L. (1956). *Amer. J. Obstet. Gynec.*, 71, 515.

Johnson, F. L., Weaver, R. T., and Walters, J. (1956). "The Management of Breech Presentations". *Canad. med Ass. J.*, 75, 319.

Jordan, M. J., Bader, Genevieve M., and Day, E. (1956) "A Rational Approach to the Management of Atypical Lesions of the Cervix". *Amer. J. Obstet. Gynec.*, 72, 725.

— — and Nemazie, A. S. (1956). "Comparative Accuracy of Preoperative Cytologic and Histologic Diagnosis in Endometrial Lesions". *Obstet. Gynec.*, 7, 646.

Kanter, A. E., and Bauer, R. (1956). "Chorionepithelioma Following Full-term Pregnancy". *Amer. J. Obstet. Gynec.*, 72, 180.

Kelso, J. W. (1956). "Surgical Management of Carcinoma of the Cervix". *Surg. Gynec. Obstet.*, 103, 565

Kobak, A. J., Evans, E. F., and Johnson, G. R. (1956). "Transvaginal Pudendal Nerve Block". *Amer. J. Obstet. Gynec*, 71, 981.

Lang, W. R., and Rakoff, A. E. (1956) "Colposcopy and Cytology. Comparative Values in the Diagnosis of Cervical Atypism and Malignancy" *Obstet. Gynec.*, 8, 312.

Latour, J. P. A., and Turnbull, L. A. (1956). "Early Diagnosis of Cancer of the Cervix". *Canad. med. Ass. J.*, 74, 713.

Laufe, L. E., and Stevenson, S S. (1956). *Obstet Gynec.*, 8, 451.

Lee, L. E, Melnick, P J., and Walsh, H M (1956). "Carcinoma *In Situ* of the Uterine Cervix". *Surg. Gynec. Obstet*, 102, 677.

Lefevre, H. (1956). "Node Dissection in Cancer of the Endometrium". *Surg. Gynec. Obstet.*, 102, 649.

Linington, A. A (1956). "Rupture of the Uterus". *S Afr. med. J.*, 30, 516

Loth, Myrna F., and Hesseltine, H. C. (1956). "Therapeutic Abortion at the Chicago Lying-in Hospital". *Amer. J. Obstet. Gynec.*, 72, 304.

Louw, J. T. (1956). "Scattered Thoughts on Cancer of the Uterine Cervix". *S. Afr. med. J.*, 30, 933.

Loxton, J. C. (1956) ... the Treatment of Recurrent Carcinoma of the Cervix".

McDuff, H. C., Jnr ... W. (1956). "Cancer of the Cervix and Pregnancy

McGarvey, R. N. ... Ovarian Cancer". *Obstet. Gynec.*, 5, 257.

McLane, C., Miller, N. F., Te Linde, R. W., and Aldridge, A. H. (1956) "Indications for Hysterectomy". *Amer. J. Obstet. Gynec.*, 72, 534.

Madden, L. H. (1956 ... ., 72, 25.

Maisel, F. J. (1956). ... of Certain

Meares, S. D. (1956 ... Aspects". *Med J Aust* ...

Meigs, J V. (1956a). *Ann. Surg.*, 143, 744.

— (1956b). "Cancer of the Cervix". *Amer. J. Obstet. Gynec.*, 72, 467.

Mendel, E. B., and Bone, F. W. (1956) "Silent, Asymptomatic Rupture of Uterus Following Normal Labor and Delivery". *Amer. J. Obstet. Gynec.*, 71, 1122.

Murdoch, R., and Barr, G. T. D. (1956) "Pathological Rupture of the Uterus Due to Sarcoma". *J. Obstet. Gynaec., Brit. Emp.*, **63**, 284.

Nesbitt, R. E. L., and Brack, C. B. (1956) "Role of Cytology in Detection of Carcinoma of Cervix"

Techniques for the Diagnosis 511.

Experiences in the Treatment Teletherapy and Intracavitary

Novak, F. (1956). "Procedure for the Reduction of the Number of Ureterovaginal Fistulas after Wertheim's Operation". *Amer. J Obstet. Gynec.*, **72**, 506.

Oppenheim, A., Rosenthal, T., and Modin, Margaret, C. (1956). "Mass Screening Techniques for Cancer of the Cervix". *J. Amer. med. Ass.*, **161**, 1067.

Palmer, J. P., and Spratt, D. W. (1956) "Pelvic Carcinoma Following Irradiation for ... nec., **72**, 497.

very from Metastatic Chorio-

1, 777.

treatment of Carcinoma of the

Randall, J. H., and Goddard, W B. (1956). "A Study of 531 Cases of Endometrial Carcinoma". *Surg. Gynec. Obstet*, **103**, 221.

Rewell, R E, and Towers, R. P. (1956). "The Tubal Mucosa in Endometrial Carcinoma". *J. Obstet Gynaec., Brit Emp*, **63**, 241.

Roblee, M. A (1956) "Cervicitis Clinic—Twenty-five Years in Review". *Amer. J. Obstet. Gynec.*, **71**, 660

Rubin, I C (1956). "Changing Concepts in Gynaecology. Problems and Goals". *Amer. J Obstet. Gynec.*, **72**, 701

— Lisa, J. A, and Trinidad, S. (1956) "Further Observations on Ectopic Endometrium of the Fallopian Tube" *Surg. Gynec. Obstet.*, **103**, 469.

Sachs, L., Serr, D. M, and Danon, Mathilde (1956) *Brit. med. J.*, **2**, 795.

Schaffer, A. L. (1956). "The Use of Chlorpromazine in Labor" *Amer J. Obstet. Gynec.*, **71**, 1247.

Schmitz, H. E. (1956) "Opportunity and Cervix Cancer". *Amer. J. Obstet. Gynec*, **71**, 1283

Silverman, A. J., Cohen, S. I., and Magnussen, F (1956) "Psychiatric Management in Gynecologic Surgery". *Amer. Practit*, **7**, 1442

Simmons, R. J. (1956). "Vaginoabdominal Approach in Pelvic-Cancer Surgery". *Obstet Gynec.*, **7**, 527.

Stander, R W. (1956). Vaginal Metastases Following Treatment of Endometrial Carcinoma". *Amer. J. Obstet. Gynec.*, **71**, 776.

Stoddard, F. J., Engstrom, W. W., Hovis, W. F., Servis, L T., and Watts, Alice D. (1956). "The Relationship of Thyroid Function to Endometrial Hyperplasia and Endometrial Carcinoma" *Amer. J. Obstet. Gynec.*, **71**, 1007.

Tabler, J W. (1956). *Amer. J Obstet. Gynec*, **72**, 959.

Turnbull, A. C. (1956). "Radiation Menopause or Hysterectomy. Part II—Mortality, Reliability and Subsequent Pelvic Cancer". *J. Obstet. Gynaec., Brit. Emp.*, **63**, 179.

Turnbull, Elizabeth P. N. (1956). "The Outcome of Pregnancy Complicated by Threatened Abortion". *J. Obstet. Gynaec., Brit. Emp.*, 63, 553.
Ulfelder, H. (1956). "The Mechanism of Pelvic Support in Women". *Amer. J. Obstet. Gynec.*, 72, 856.
Wachtel, Erica (1956). "A Suggestion for a Cytological Test of Cancer Cure". *J. Obstet. Gynaec., Brit., Emp.*, 63, 176.
Waters, E. G. (1956). "Vaginal Prolapse Technic for Correction and Prevention at Hysterectomy". *Obstet. Gynec.*, 8, 432.
Watts, W. F., and Kimbrough, R. A. (1956). "Hysterectomy. Analysis of 1,000 Consecutive Operations". *Obstet. Gynec.*, 7, 483.
Wear, L. E. (1957). "Uterine Myoma as a Hereditary Disease". *Lancet*, 1, 25.
Weinberg. A., Rizzi, J., McManus, R., and Rivera, J. (1956). "Localization of the Placental Site by a Radioactive Sodium Isotope (Na24)". *Obstet. Gynec.*, 8, 396.
Wharton, L. R. (1956). "Methods of Preventing Injury to the Uterus and Bladder During Gynecological Operations". *Ann. Surg.*, 143, 752.
Wheeler, C. B., Jnr. (1956). "Carcinoma of the Cervix with Early Stromal Invasion". *Amer. J. Obstet. Gynec.*, 72, 119.
Wilds, P. L. (1956). *Obstet. Gynec.*, 8, 385.
Williams, P. C., and McMahon, T. B. (1956) *Amer. J. Obstet. Gynec.* 71, 1264.
Zettergren, L. (1956). "The Histogenesis of Uterine Myomata". *Acta Obstet. Gynec. Scand.*, 35, 366.

ADVANCES IN THE STUDY OF DISEASES OF THE BREAST

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MAMMILLARY FISTULA

"Chronically discharging sinuses" and "recurring subareolar abscesses" have been known for many years and their treatment has often been attended by much disappointment. These so-called sinuses and abscesses can be drained or excised on numerous occasions, but they have an aggravating tendency to recur. Often, patients who have undergone many operations on one or both breasts agree to the desperate remedy of mastectomy in order to rid themselves of a grave embarrassment. The credit for first describing the true pathological anatomy of these lesions goes to Zuska, Crile and Ayres (1951) who found that the "sinus" or abscess was in continuity with the lumen of a duct and was in reality a fistula. At about the same time, and independently, the nature of these lesions was discovered at the Breast Clinic at Guy's Hospital where a series of such cases was under treatment (Atkins, 1955)

Clinical features

Mammillary fistulas may occur at any age from puberty to the menopause. It is not uncommonly a bilateral condition and is often associated with an indrawn nipple. Some of these cases first occur during pregnancy or in the early days of lactation. The patient may present with a long history of an infective lesion, generally at the margin of the areola, which "comes up", bursts, and leaves a discharging area which eventually heals over. After a time, the abscess recurs, bursts, or is incised, and the whole cycle is repeated

Pathology

The pathology of the lesion is not clearly understood, but from its frequent association with a retracted nipple, and by analogy with similar conditions elsewhere, it is reasonable to suppose that the initial abnormality is an obstruction at the duct orifice which prevents the natural dissipation of normal duct secretions.

This obstructive element may be simply the distortion of the duct by nipple deformity, or it may arise from the plugging of the duct by inspissated epithelial cells or colostrum in association with the prodromal phase of lactation. In one



FIG 28 —Mammillary fistula

case the obstruction was due to an unsuspected carcinoma, and it is therefore necessary to perform a biopsy on part of the wall of the fistulous track to exclude this possibility. In no case has tuberculosis been implicated, although many patients have received anti-tuberculous therapy under the mistaken impression that this was the nature of the disorder.

Treatment

Treatment of these conditions consists in passing into the external opening of the fistula a probe which, by gentle insinuation, can be made to emerge without trauma from one of the ductular orifices at the nipple (Fig 28). Under a general anaesthetic the track is exposed between the ductular orifice and the external opening of the fistula at the areolar margin, thus liberating the probe as in the operation for fistula in ano. A part of the fistulous tract is excised for section in

case the obstructive element leading to the fistula is neoplastic. At this stage, some surgeons would excise the whole fistula, sew up the wound and seek to obtain healing *per primam*. Such a plan, if successful, saves the patient much inconvenience, but the chances of a recurrence are too great to accept this as the standard procedure, particularly if the fistulous tract is complicated with two or more external openings. A better method is to cut away the overhanging walls and roof of the tracks, converting the whole into a shallow saucerized cavity and allow this to heal up from the bottom. When there have already been so many disappointments, this method, which ensures a successful issue, is to be preferred and is well tolerated by the patient even although she may have to attend every second or third day for some weeks after, for the reapplication of a bland, non-sticky dressing

DISCHARGES FROM THE NIPPLE

Proliferative processes within the breast lead to a shedding of cellular and liquid disintegrative products into the lumen of the duct. If these processes are taking place at some distance from the nipple, the length and tortuosity of the intervening duct precludes their discharge at that orifice and, if accumulation exceeds absorption, these products lead to distension and cyst formation. If, on the other hand, the same processes occur near to the nipple orifice, for instance, [illegible]

Nipple discharges are either "colourless" (straw-coloured) or coloured. The significance of a colourless discharge is little more than that of cyst formation and often has the same cause. The chances of a cancer occurring in such a breast are probably greater than in a normal breast, but not much greater, and it is a prudent measure to observe these cases rather than to interfere surgically.

When the discharge is coloured, it is necessary to discover whether the colour is due to haemoglobin or its breakdown products on the one hand, or melanin on the other. If the colour itself does not betray the diagnosis, as in brown or black discharges, a bead of the discharge is withdrawn into a capillary glass tube and examined spectroscopically, when the presence of haemoglobin or one of its breakdown products will at once be revealed

A discharge coloured from melanin has no more significance than a colourless discharge, but one containing haemoglobin may have a more grave significance. The source of the bleeding can nearly always be found by pressure with the finger at successive points around the areolar margin; at the same time, if necessary with the aid of a magnifying glass, the duct orifice from which the blood is emerging is observed

Microdochectomy

In such a case the operation of microdochectomy is performed. The patient is given a general anaesthetic and the surgeon wears a pair of binocular loupes to magnify the nipple. The duct from which the blood is emerging is then cannulated with a sewing needle from which the point has been cut and the severed end carefully rounded This can readily be made to sink into the duct up to the eye of the needle

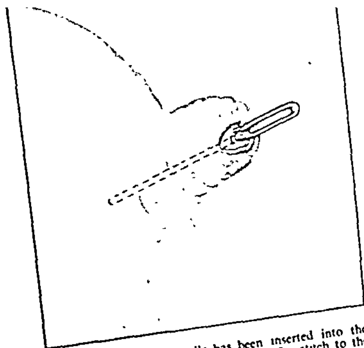


FIG 29 —The blunt needle has been inserted into the bleeding duct and secured by means of a stitch to the adjacent skin

mosquito forceps, a collar of skin 3 millimetres in diameter is circumcised around [illegible] cluding the stitch and the protruding eye of the needle. This [illegible] the desired direction and two flaps, consisting of the skin of [illegible], are elevated on either side (Fig. 30). Haemostasis must be absolute and [illegible] the bleeding points are touched with the diathermy needle. In this way, the offending duct can be clearly seen, dark and full of blood, through the ground glass appearance of the infiltrated tissues. If the duct is not full of blood, the inlying needle allows ready identification. This duct, together with its appended ductular systems, is then dissected out, using the needle as a handle, by means of the small-bladed knife or with indectomy scissors. Should the duct or one of its branches be accidentally cut between the lesion and the nipple, bloodstained fluid will emerge and the further ramifications of the system may be traced. Generally, the whole system can be dissected out without damage, and on slitting the duct up subsequently, the surgeon is usually rewarded by discovering papillomatous tissue. A few stitches in the nipple and surrounding areola

restore the parts to normal and the function remains unimpaired. The duct and its appended breast tissue are sent for section and further surgical interference is necessary only if malignancy is revealed on histological examination

If a colourless discharge persists for so long or is so profuse as to be a source of annoyance, the operation of microdochectomy is equally applicable and is just as successful provided the appropriate duct can be accurately localized. It remains to consider those cases where localization is not possible or where a bloodstained discharge is found to be coming from many ducts. In young women, these cases

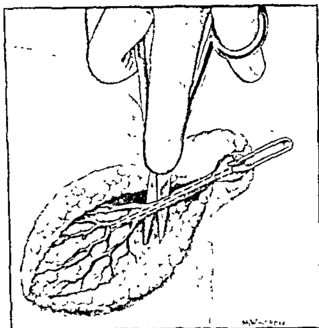


FIG 30 —The duct and its ramifications are being dissected away from the rest of the breast tissue

may be observed until the source can be localized, the discharge stops, or other physical signs demanding interference obtrude In older women, when the chances are greater that the cause is a serious one and where the physiological, psychological and physical effects of mastectomy are not so objectionable, this operation should be advised without delay

CANCER

Work in the experimental field is chiefly concerned with the identification and study of the tumour agent in cancer of the breast in the mouse This work, which is of fundamental importance in the study of cancer as a whole, has as yet had virtually no impact upon the problem of breast cancer in the human subject where the influence of a tumour agent is still unproved Statistical surveys (McKinnon, 1951; Jones, 1956) continue to disturb any complacency which surgeons may feel in regard to the success of their methods in the treatment of early cancer of the breast and prompt some to be even more radical and others to retire behind a defensive armour of therapeutic nihilism

The argument between those who advocate radical mastectomy in the treatment of early cancer of the breast and those who, like McWhirter (1955) advise simple mastectomy with irradiation of the lymphatic fields, rages to and fro. It is not proposed to enter into this controversy except to observe that it is a duty of those who advocate new and unorthodox methods of treatment to produce evidence that they have been subjected to adequate control.

Supra-radical operations

The investigations of Handley, Patey and Hand (1956) into the significance of the internal mammary chain of lymph nodes in disseminating breast cancer continues to be of the greatest importance. It has prompted some surgeons (Urban, 1952) to include this lymphatic field in the tissue excised in the operation for breast cancer and some (Wangensteen, 1952) go further and ablate the lymphatics in the supraclavicular triangle as well. It is too early yet to say how far these extravagant excursions into distant fields of spread will succeed. Many of these operations are very disfiguring and lead to a considerably increased morbidity, if not mortality, so that their performance is for the most part left in the hands of those particularly interested, who will in due course report the long-term results of their endeavours.

Medical modification of hormonal environment

Methods of modifying the hormonal environment in late cases of cancer of the breast by means of the administration of hormones have settled into an established routine. It is now almost universally conceded that women up to and for a few years after the menopause are best treated by the administration of androgens, usually in the form of testosterone propionate, 100 milligrams by intramuscular injection 3 times a week; and women more than a few years past the menopause are treated by oestrogens, using stilboestrol in doses of 50 milligrams a day by mouth or, if this upsets them, using some other oestrogen preparation such as ethinyl oestradiol in doses of 1 milligram a day.

Surgical modification of hormonal environment

Adrenalectomy and oophorectomy

The most interesting advances in hormone therapy have, however, been made in the field of surgical attack upon hormone-secreting organs. With the availability of cortisone for replacement therapy and following the lead of Huggins (1953), it was possible to treat patients with advanced cancer of the breast who failed to respond to the administration of the appropriate hormone or who, having over-responded, had ceased to do so, by means of adrenalectomy with oophorectomy, thereby removing so far as is possible all the tissue known to be responsible for the elaboration of oestrogens. This operation was taken up in Great Britain by Cade (1954) and others (Atkins and his colleagues, 1957). In a proportion of cases satisfactory results, and in a few cases brilliant results, were achieved. In order to obtain a more accurate assessment of the results of this and other procedures, the Mean Clinical Value method (Atkins and his colleagues, 1957) was used in the Guy's series whereby a patient's response to treatment is given a numerical value

between 0 and 12 at each of the routine four-weekly follow-up visits, and their response to treatment can then be charted graphically.

In addition, this series of marks may be used to compare the response of one patient with another or to contrast statistically the results of treatment on a group of patients by one method with the results in a comparable group treated by another. This has proved to be a most valuable tool and, without it, it is doubtful whether any two methods of treatment of approximately equal value can be accurately compared

Hypophysectomy

With the introduction of hypophysectomy by Luft and Olivecrona (1953) it was possible to build up two series of patients, the one group treated by adrenalectomy with oophorectomy and the other by hypophysectomy, and to compare these two groups statistically using the Mean Clinical Value as an assessment of response. A comparison of these two methods of treatment indicates that hypophysectomy is at least as satisfactory a method of treating these patients as adrenalectomy with oophorectomy and may well prove to be better However, to achieve results with hypophysectomy which can compete with adrenalectomy and oophorectomy in regard to the immediate mortality of the operation, it is necessary to have an experienced neurosurgical service of a quality of which few centres could boast. For this reason and because of the undeniably effective results of pituitary destruction, alternative methods of doing this have been tried.

Radiotherapeutic techniques—The technique of the introduction of cannulas through the nose into the pituitary fossa under radiographic control has been perfected by Forrest and Peebles Brown (1955). Through these cannulas radon seeds were originally implanted into the pituitary fossa, but the scatter of radiation proved to be too great and the optic chiasma was endangered. Recently, therefore, yttrium, a pure beta-ray emitter, has been used in an attempt to confine the sphere of activity of the ionizing radiation strictly to the pituitary fossa It remains to be seen whether these methods will be as effective as surgical hypophysectomy in destroying the pituitary and how far complications such as cerebrospinal rhinorrhoea may prove insuperable disadvantages. Meanwhile, interesting and useful investigations have been undertaken by Tobias and Lawrence (1956) at the University of California in Berkeley. Using their 350 M e v synchro-cyclotron, they have thrown a proton beam through the skull achieving a maximum dose at the pituitary fossa by rotation of the patient's head from side to side through a wide arc with the pituitary fossa adjusted to the centre of this rotation and with radiographic control. Surprisingly accurate collimation can be obtained with these high voltages and subsequent histological examination in the case of animals, and biochemical investigation in the case of their human patients, indicate a satisfactory subtotal to total pituitary destruction without serious scatter. It is hoped that a similar programme of research may shortly be possible in Great Britain with the 400 M e v synchro-cyclotron at Liverpool University

It needs to be explained that researches into all these methods will be productive only of confusion unless they are controlled by reference to a comparable group treated by a rival method, and unless the comparison is made by using some such rigid criteria as is afforded by the Mean Clinical Value

Selection of patients for major surgery

There remains the pressing question of finding a criterion of suitability for these major surgical procedures. It is clearly objectionable to remove a woman, with only perhaps a few months or weeks to live, from the security and loving care of her family circle and to perform a major surgical procedure upon her if that operation is not going to improve her well-being. In only about one-third of these patients with far-advanced disease is a worthwhile benefit achieved by either of the above two operations and at present there is no means of telling beforehand which patients are going to respond and which will fail to respond.

It has been claimed (Huggins and Dao, 1954) that the histological picture will afford some help, that the adenocarcinomas respond better than other types, but this view has found no confirmation amongst other workers. When there are bone secondaries, the calcium excretion in response to the administration of oestrogens (Emerson and Jessiman, 1956) has been held to reveal hormone dependency, but should this be substantiated, it would only be of value in those cases with multiple bone secondaries Hadfield (1956) has related the mammotrophic potency of the urine to hormone dependency, but the application of this method to the selection of cases suitable for adrenalectomy or hypophysectomy has still to be tried. Recently, Allen, Hayward and Merivale (1957) have investigated the individual 17-ketosteroids in the urine of 15 patients subjected either to adrenalectomy with oophorectomy, or hypophysectomy. The ketosteroids are separated by chromatography on alumina columns into two main groups—the 11-de-oxygenated and the 11-oxygenated 17-ketosteroids They found that, in the 11 out of the 15 patients who responded to treatment, the ratio of de-oxygenated to oxygenated 17-ketosteroids in the pre-operative specimens of urine was greater than unity; in the 4 cases that failed to respond, it was less than unity.

It may well be that further researches into this aspect of the biochemistry o urinary secretions may provide us with a criterion for operability and so save from painful disturbance the two-thirds majority of these desperately ill patients who would fail to respond to surgical therapy of this nature.

ABSTRACTS RELATING TO DISEASES OF THE BREAST

Cancer of the breast

Application of research in physiology

growth is

production and are usually followed by a growth regression in hormone-dependent breast cancer. In a large proportion of patients, however, progressive growth of the

removal of the ovaries and adrenals rarely results in "steroprivation ', even at the low

cancer, the urine of post-menopausal women shows little mammotrophic potency. The tumour is therefore probably pituitary-independent, and could not benefit by hypophysectomy.

Characteristics of adrenal-dependent cancers

form of adenocarcinoma Patients with this spheroid type of tumour often excrete significant amounts of oestrogenic hormones in the urine after elimination of ovarian activity by irradiation or oophorectomy. Another clinical characteristic is the ability of the remaining breast to lactate on stimulation with luteotrophin, lactation indicating physiological maturity of the mammary epithelium and the consequent presence of adequate hormones, both steroid and protein. Twenty-one women were tested in this way

to surgery

Role of histology in treatment

between grade and survival examined From this, a clear parallel between grade and prognosis was found to exist, from 2½ to 3 times the number of patients being alive with grade 1 tumours than with grade 3, at 5 and 10 years after treatment. Case 1 *in the series* illustrates the slow progress of the growth and the long life of the patient with grade 1 cancer, while case 2 demonstrates the reverse in grade 3 cancer Results of grading thus

provide a valuable prognostic guide. By combining stage and grade, a classification is produced which includes not only the apparent extent of the tumour, but also its potential malignancy and possible metastasis. On this combined basis, the number of patients alive at 5 years in this series, ranges from 84 per cent for stage 1, grade 1, to 4 per cent for stage 4, grade 3, a striking feature being the high survival rate of grade 1 cases in every stage of the disease. In the 10-year survivals in 633 cases, the same pattern is maintained. The combination of histological grading with clinical staging discloses that there is still hope for a patient presenting with a stage 2, or even stage 3, growth, provided it is of low grade malignancy. It also contributes to a more direct investigation of the radiosensitivity and radio-curability of certain growths. So far, excellent clinical and histological responses have been observed in all 3 grades, even well-differentiated grade 1 carcinomata responding as successfully as some highly anaplastic grade 3 growths. Thus Paterson Ross (1939) concluded that adenocarcinomas are relatively insensitive, while highly anaplastic tumours show the most marked changes.

Control of cancer mortality

McKinnon (1954) reviews the control of cancer mortality. Of all major cancers, breast cancer is the most accessible for diagnosis and treatment, while its mortality records provide the best comparative basis. In Canada, Massachusetts and England, despite vastly different systems of control, the trends of age-specific mortality are practically identical and level. Early treatment, therefore, appears to make no impression on the respective mortality rates. If its failure to reduce mortality is due to the development of remote metastases implanted earlier and spreading by the blood stream before interference is practicable, no type of treatment of the primary lesion can hypothetically affect mortality. Evidence to the contrary is therefore examined. The limitations of histopathology are such that no distinction can be made between remotely metastasizing, locally metastasizing and non-metastasizing types, nor between lethal and non-lethal, again proving that a difference in survivals cannot definitely be attributed to differences in time or type of treatment. Since stage 1 cancers include tumours of all durations as well as those lacking potentiality for axillary or remote lethal involvement, survivals are not reliable evidence of lethal cancer treated early, either in time or development. Moreover, since decreasing 5-year survivals are found in untreated cases of consecutive durations, a decrease in survivals in treated cases with increasing pre-treatment durations, cannot be attributed to delay in treatment. On the other hand, clinical and pathological studies show that it is the type of cancer which affects survival. Bloom (1950) states that "the outcome in mammary cancer is determined largely by the histological type of growth rather than by prompt treatment as soon as the lesion is discerned". As the primary lesion has no known specific influence on the development of remote metastases after their implantation, it cannot be assumed that treatment of this lesion with its lymphatics can influence such development or postpone death. This incontrovertible conclusion explains and reconciles the similarity in survival rates for radically different treatments and, with the histopathological limitations, elucidates the inconsistencies "rampant" throughout breast cancer literature.

Comparison of treated with untreated cancer

Keyes and his colleagues (1954) compare treated with untreated breast cancer. Halsted's radical mastectomy having been condemned as inadequate, McKinnon (1951) urged a reappraisal of mastectomy results after pathological elimination of "borderline" cancer. A group of pathologists therefore eliminated from 100 surgical cases diagnosed as carcinoma, 6 as borderline cancer, with a 7th as lymphosarcoma. The next seven cases of proved infiltrative carcinoma were substituted. The resulting 100 cases had all undergone radical mastectomy by Fischel; 34 had received post-operative irradiation. Fischel's patients were compared with 100 untreated fatal cases of Daland's. As compared with 3 years 5 months, the survival time of Daland's patients, Fischel's treated patients lived for 6 years 1 month after onset. Mastectomy therefore had almost doubled their survival period. Fischel's was the younger series by nearly seven years. The most responsive age-group was from 45 to 54 years of age, the least, over the age of 60 years. The average time

at which Fischel performed radical mastectomy was 10 months after onset; Daland's untreated patients delayed their first consultation for approximately 1½ years. "Early" ... mastectomy, operation

... ctomy, however,

meant two years' shorter survival Invasion of the axilla reduced the survival period by 2½ years. Mastectomy with irradiation added one year to Fischel's patients with bone

Involvement of internal mammary lymph nodes

chain has led to a more extended procedure. Performed on 60 primary cancers, the

described. They illustrate the importance of lymph drainage from the areola to the internal mammary basin, a fact often ignored in the absence of axillary metastases in Paget's disease. In 7 cases, metastases were found in the internal mammary chain only; in 12 additional cases, deposits were also present in the axillary nodes The primary cancer was situated in the medial part of the breast in 13 cases, and was subareolar in 14. From these two sites alone, metastases were found in the internal mammary nodes in

Super-radical mastectomy

WANGENSTEEN and his colleagues (1956) describe the extended or super-radical mastectomy for cancer of the breast. Recent appreciation of the extent of the potential lymph node drainage area indicates that the Halsted radical mastectomy is inadequate. Cancer spreads through lymphatics to the parasternal and supraclavicular nodes as well as to the axillary Each of these drainage areas can be a primary, rather than a secondary lymphatic filter, making excision of one area as important as another. Histology shows that mammary cancer commonly metastasizes to the internal mammary and supraclavicular nodes These sites therefore cannot be ignored by the surgeon, although McWhirter of Edinburgh advocates simple mastectomy followed by irradiation The authors, however, believing that the "last outposts" of the areas of spread should be *removed, have devised an operation to those ends This super-radical operation is done* in one or preferably two stages, but invariably includes the conventional radical mastectomy with supraclavicular and mediastinal resection. The mastectomy which includes the axillary dissection constitutes stage I. The stage II incision begins at the level of the thyroid cartilage and extends down to the fourth intercostal space Division of the sternum and removal of the first rib provides exposure of the supraclavicular and retrosternal areas The supraclavicular dissection is described. The split already made in the sternum provides ready entry into the mediastinum for the parasternal and mediastinal dissection This also is described. During this part of the operation the pleural cavity is intentionally entered. To promote lung expansion and permit drainage of blood and serum,

catheters are placed in the cavity and brought out through stab wounds. Post-operatively, the arm is bound to the chest to minimize the risk of sternal separation. With few exceptions, the super-radical operation was employed for patients with proved axillary lymph node metastastes, or for those with cancer in a medial sector of the breast. The operative mortality rate was 12·5 per cent; in the stage II procedure it is lower than in the stage I. The over-all survival rate was no greater than in radical mastectomy, but in this series of 64 patients, there were 37 who could not have been cured by radical mastectomy alone. These 37 patients had metastases removed from the supraclavicular or mediastinal regions, or both; in a 1 to 7-year follow-up period 6 were alive and well, 6 were alive with residual cancer, and 25 were dead. These results are disappointing and a super-radical operation does not appear to offer any increased promise of cure. It may however be a stage in development of an adequate and satisfactory operation.

Radical mastectomy with en bloc in continuity resection of the internal mammary lymph node chain

URBAN (1956) discusses radical mastectomy with *en bloc* in continuity resection of the internal mammary lymph node chain. Primary control of breast cancer depends not only upon earlier detection and surgery, but also upon more extensive removal of the growth and its primary lymphatic drainage area. In this procedure, the primary cancer is removed in continuity with both its primary lymph node drainage depots, the axillary and internal mammary chains. An incision is then made encompassing the tumour and extending from the pectoro-deltoid groove to the costal margin. The chest wall is cleared by muscular dissection until that portion containing the internal mammary node chain is isolated. The pectoralis major muscle is cleared and split to expose the 1st rib and arch of the manubrium. The upper border of the 6th rib and the anterior surface of the sternum are similarly exposed. The chest wall resection then takes place. The thoracic cavity is entered through the upper end of the first interspace and the lower end of the fifth. The incisions are joined by dividing the sternum and thus forming a trap door in the chest wall. The ribs and intercostal soft tissues between the 1st and 6th ribs are cut at the costochondral junctions and the resulting portion of the chest wall reflected laterally. The chest wall defect is repaired with a fascia lata graft under tension, and the chest drained. The procedure is now concluded as in the classical mastectomy, the tumour is removed and the wound closed. Penrose drains are inserted in the axilla and beneath the opposite breast. In order to mobilize the medial flap and thus obtain primary closure, the opposite breast is undermined from its pectoral attachment. The details of a strict post-operative routine are enumerated. Radiographic examination has only been given in cases where positive nodes were found in the apex of the axilla, or in the first interspace of the mammary chain. Positive internal mammary nodes were found in 35 per cent cases, axillary nodes in 50 per cent. Fourteen patients with negative axillary nodes had positive internal mammary nodes. The highest incidence of metastasis in the internal mammary chain occurred in the 2nd interspace, the next highest in the 3rd, the lowest in the 1st. This operation has been performed on 215 patients with only one post-operative death. An increased 3-year survival rate was obtained in the first 70 primary operable cases. Only three local recurrences were noted. Five patients with positive nodes in the axilla, as well as in the internal mammary chain, were alive and well between 4 and 4½ years after surgery, with no evidence of disease. The procedure is indicated for stage I and early stage II cancers, particularly when the primary lesion arises in the central and medial sectors of the breast; it is not intended for advanced cases.

Bilateral adrenalectomy and oophorectomy for advanced cancer

GALANTE and his colleagues (1954) review bilateral adrenalectomy for advanced breast cancer, with observations on the effect of the liver on the metabolism of adrenal cortical steroids. Oophorectomy, having proved beneficial in advanced metastatic mammary cancer (Beatson 1896), this operation, with bilateral adrenalectomy, was introduced by Huggins in 1952, based on the assumption that certain tumours retain the parent tissue property of being influenced by their hormonal environment. Ablation of

both ovaries and adrenals, therefore, should produce an oestrogen-deficient environment inimical to tumour growth. Thirty-one unselected cases of advanced metastatic carcinoma were subjected to adrenalectomy and oophorectomy. Criteria for operation included objective evidence of metastases, symptoms relative to these lesions, failure of former alternative therapy, and random histological selection of tumour. Pre-operatively, estimations of adrenal cortical function, blood and urine, basic phosphates, inorganic calcium and phosphorus were determined. A complete bone survey was made. Either cortisone acetate or hydrocortisone for adrenal replacement was administered immediately before, or at the time of, surgery. On the 5th day, 12·5 milligrams cortisone acetate were given orally every 8 hours. The rate of urine flow was measured In 20 cases the adrenals were removed through flank incisions, the ovaries through a midline incision; in 11 cases, simultaneous removal was performed through a transabdominal approach. In a 2 to 25-months follow-up, 19 patients had a mean survival period of 10½ months. Subjective improvement was obtained in 45 per cent of cases Objective improvement in 22 per cent, included regression in lymph node, lung, bone and skin metastases. No [illegible]

the right adrenal gland, the blood from the left adrenal was shunted into the portal circulation through the splenic vein Urinary excretion of hydrocortisone-like substances was found to be unchanged, whereas 17-ketosteroids showed marked diminution and oestrogens were absent Bilateral adrenalectomy and oophorectomy, then, remains only a palliative procedure on account of the transitory arrest of the metastatic spread

Adrenalectomy

CADE (1955) discusses adrenalectomy for breast cancer, now recognized as a hormone-dependent tumour Beatson, in 1896, and later Lett, reported the influence of oophorectomy on advanced cases. Huggins and Bergenstal (1951–52) showed that the adrenal cortical hormones sustain breast cancer while their withdrawal frequently produces regression. Bilateral oophorectomy and adrenalectomy therefore should eliminate all sources of hormones influencing tumour growth and create a physiological environment poor in steroids. Although mammary cancer varies in its rate of growth and power of dissemination, it almost inevitably invades the regional lymph nodes, skeleton and viscera. In 56 previously treated patients now submitted to adrenalectomy, skeletal, visceral or soft-tissue metastases were widespread Pre-operatively, patients are assessed regarding their general condition The output of 17-ketosteroids and oestrogens is studied and adrenocortical function tested Blood transfusion and cortisone are given. During and immediately after operation, noradrenaline is used only if the blood pressure falls. [illegible]

[illegible] 13 6 per cent. [illegible] ths. In 14 cases [illegible] ained. In 13 patients [illegible] was great; [illegible] improvement included healing of pathological fractures, reossification of skeletal [illegible] tases, regression of visible and palpable lesions. Two illustrative cases are recorded. The longest survival period was 24 months, the shortest, 6 weeks. No method of [illegible] the result of operation is available, although attempts have been made to [illegible] with age, extent of the disease, and type of tumour, Huggins and others [illegible] adenocarcinoma is the most responsive The incidence of metastasis in the adrenal is high, and accurately reproduces the histological variety of the primary growth.

Hypophysectomy in treatment of advanced disease

RAY and PEARSON (1956) discuss hypophysectomy in the treatment of advanced breast cancer, following cumulative evidence of pituitary hormonal influence [illegible]

tases, radiologically identifiable secondaries in bones or lungs, or cancerous pleural effusion. Both during and after surgery, cortisone was administered In the first 24 hours, most patients developed diabetes insipidus; a revision of surgical technique, however, has

probably from metastases, 3, of causes attributable to operation and believed to be interruption of important superior cerebral veins. On the whole, however, patients do

this report. Hypophysectomy will produce new remissions in patients who have temporarily benefited by castration and adrenalectomy, and it is probably preferable to adrenalectomy as a second operation following castration.

Co-existence with pregnancy

WHITE and WHITE (1956) discuss breast cancer and pregnancy. These conditions co-exist more frequently than is realized, the incidence being about 1 in 35 patients. Forty-nine such cases are recorded. In 14 instances, a tumour was observed during pregnancy but treatment was deferred until after the nursing period. In 2 cases, no treatment was instituted until after the second pregnancy, with consequent delays of 48 and 13 months respectively. The remaining patients were treated following the first pregnancy, with an

patients a tumour was noted and treated during nursing; of 5 in whom it was located in

t is illustrated by a

therefore to be good, especially where the tumour is localized. One patient had ... children 2 and 4 years after radical mastectomy for carcinoma localized to the breast. She was without evidence of metastases after 34 years and the children were well. The condition of the patient, then, rather than the time interval after operation, should determine the advisability of future pregnancies. Abortion cannot be shown to have any significant effect on the course of the disease.

Malignant lesions of the nipple

CONGDON and DOCKERTY (1956) discuss malignant lesions of the nipple exclusive of Paget's disease. Tumours of more than 2.5 centimetres in diameter were also excluded The embryology and anatomy of the breast are described. In 10,000 cases, malignant disease could only be proved to have originated in the nipple in 29 cases; these comprise

tissue with cords and plugs of glandular epithelium

Normal post-menopausal women

HADFIELD and STRETTON YOUNG (1956) review the mammotrophic potency of the urine of normal post-menopausal women. The urine from 57 such healthy women was examined. Each of 10 weanling mice was injected with 0·2 millilitre untreated urine at room temperature, twice daily for 5 days. The results showed that an appreciable portion of post-menopausal urines possess a significant degree of mammotrophic potency, ranging from 4 to 14·5. In this study, the figure was 58 per cent. In comparing these figures with those obtained from pre-menopausal urines, the variations in mammotrophic potency during the menstrual cycle must be considered. During the first half, the pre-menopausal potency is low; during the second half (17th to 22nd days) it reaches a maximum of between 6 and 16·8. A comparable potency range of 6 to 14·5 (or 43·8 per cent) was found in the post-menopausal urines, this percentage closely approximating that of the pre-menopausal urine between the 17th and 22nd days of the cycle. One difference however exists between the pre-menopausal and post-menopausal woman regarding mammotrophic potency. Even during the first half of the cycle, pre-menopausal urine is nearly always potent although the value is low, but potency was almost absent in 24·5 per cent urines collected over the whole post-menopausal age period. A comparison of the mammotrophic potency of post-menopausal women with the results of cytological examination of vaginal smears and histological examination of the endometrium is informative, and shows that, as ovarian function fails, blood oestrogen falls, while gonadotrophin rises and remains high. It seems, therefore, that the mammotrophic potency of post-menopausal urine is, at least in part, due to the liberation of a mammotrophic pituitary hormone whose production is governed by the same reciprocal relationship with failure of ovarian function, as that of gonadotrophin. Although mammotrophic potency tends to fall with age, it may be retained till 70 years or later

Mean clinical value

In their paper on adrenalectomy and hypophysectomy for advanced breast cancer, ATKINS (1957) and his colleagues discuss the use of the "mean clinical value" (M.C.V.) for assessing results. In this method a number between 0 and 12 is assigned to the patient at each 4-weekly visit, according to her response to treatment. A base-line for each lesion is established when the patient is first seen and before treatment is begun; subjective symptoms, with the exception of pain, are not used in determining response. At each visit, if the lesion has improved it is given 2 marks, if stationary, 1 mark and if worse, 0, the marks are then added and the total divided by the number of lesions, giving an average mark for the whole disease, as this figure would be difficult to handle, the result is multiplied by 6. Every 4 weeks the patient is re-assessed and a fresh M.C.V. allotted, so that a chart of progress can be made. If one of the factors used for computing the result is radiological, a new skiagram is taken only at every third visit and the previous value of this factor used to compute the M.C.V. in the intervening assessments. An unavoidable weakness of the method is that the state of a lesion is always compared with the original state of that lesion and not with that at a previous visit, this explains the tendency in some cases for a precipitate drop in the chart shortly before death. Two charts may be used for comparing the results of 2 methods of therapy.

REFERENCES

Allen, B. J., Hayward, J. L., and Merivale, W. H. H. (1957). *Lancet*, 1, 496.
Atkins, H. J. B. (1955). *Brit. med. J.*, 2, 1473.
— Falconer, M. A., Hayward, J. L., and Maclean, K. S. (1957). *Lancet*, 1, 489.
Bloom, H. J. G. (1956). *Brit. J. Radiol.*, 29, 488.
Cade, S. (1954). *Ann. R. Coll. Surg.*, 15, 71.
— (1955). *Brit. med. J.*, 1, 1.

clinical state, which will be shown by abnormal mental rolled muscular twitching, and (5) occasionally a marked te considered that the only contra-indication to artificial 1 the patient has a tendency to bleeding. There must be a hose who recover from acute renal failure Unless there has sease or complication to produce increased renal damage, on of the renal function does not seem to occur.

Merrill (1956) have followed-up 16 patients They found no the severity and duration of the acute renal failure and the ysfunction

THE KIDNEY

1 of the human kidney

en attempted and, hitherto, without much success. Merrill and 56) have performed a successful homotransplantation of a healthy identical twin to another they reported the continued survival of months The same workers have since been able to transplant two t would seem that to attain success it is essential to have identical hom has two good kidneys and the other two bad kidneys Their , a man aged 24 years, with hypertension, albuminuria and a blood tween 75–100 milligrams for 100 millilitres There were changes in els and the heart was enlarged. Over a period of some months his ame worse and he developed convulsions, drowsiness, nausea, psychotic symptoms. After dialysis with an artificial kidney, he was elieved Full-thickness skin grafts were exchanged between the is twin brother, and a month later a biopsy of these transplants il-growing skin tissue A normal left kidney was removed from the and transplanted to the patient, the renal vessels being anastomosed l iliac artery and vein The donor twin made an uneventful recovery arkable gift During the first month after operation, the homograft l and the patient gained weight The blood urea fell to 14 milligrams : blood pressure was 120/60 millimetres of mercury. There was a n and a few white cells in the urine but no oedema and the optic ormal An intravenous pyelogram two months after operation excretion with good concentration of dye in the transplanted 'ectable excretion in the two diseased kidneys. Subsequently, both kidneys were removed. Histological examination of these organs ronic glomerulonephritis. This is a great triumph of team work. " certain that the twins were identical. There had apparently 'a, there was a Darwin tubercle present on the ears of both brothers or sisters, and the eye colours in each were exactly decision to operate was really based on the survival of the grafted kidney was placed operitoneally within the nplantation of a short se " the ureter directly into kidney to drain reasonab l; the blood supply was for 82 minutes.

PROGRESS IN GENITO-URINARY SURGERY

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INTRODUCTION

In this brief survey of the progress of urology in 1956, much has had to be omitted and some cannot perhaps be properly classified as progress. An attempt has been made to select some of the more salient features of urological interest and especially those which at the present time, might be termed fashionable.

ANURIA

Recovery from acute anuria

If anuria or oliguria is due to shock from blood loss, it should be treated by intravenous transfusion of sufficient blood to replace that which was lost. If it is due to shock without blood loss, then extracellular fluid volume loss must be treated with a balanced salt solution such as Hartmann's solution. If both factors have contributed then both blood and a balanced salt solution will have to be given. If the cause of the anuria or oliguria is recognized and can be removed, adequate therapy usually results in fairly early restoration of renal function. Organic anuria or oliguria when there is an irrevocable change, may be due to protracted functional anuria, to transfusion reaction, to toxic or chemical nephrosis, to acute nephritis from infection, or to an acute exacerbation of chronic nephritis. In treating organic anuria it is important to eliminate the intake of exogenous potassium and protein, to restrict water and sodium intake, but to give 100 grammes of carbohydrate daily [illegible] istration of calcium, [illegible] glucose and insulin [illegible] administration of digitalis

Sturman (1956) suggested that the indications for artificial haemodialysis are (1) uncontrolled hyperkalaemia, (2) water intoxication, (3) progressive acidosis.

cases a definitive diagnosis was made by biopsy in 91 In 9, neither the pathologist nor the clinician could arrive at a definite diagnosis. This may have a place in medical urology, but it can be of little help in the diagnosis or treatment of a disease amenable to surgical treatment.

Necrotizing renal papillitis

This is a condition which has recently been described by Whitehouse and Root (1956) as a complication of diabetes mellitus There are two clinical pictures, first the acute fulminating type which causes early death and is usually thought to be a result of septicaemia. The second is a subacute type characterized by renal infection with acute exacerbations terminating in oliguria and death Whitehouse and Root found 11 cases of necrotizing papillitis in 14,252 diabetics. Ten of these 11 patients died; one was treated by nephrectomy but died two years later, with renal failure

Injuries of the kidney

Jones (1955) reported the surgical management of 24 cases of renal trauma All of these must have been severe injuries since 17 were treated by nephrectomy and only 7 conservatively. The frequency of intervention appears to be a swing in the wrong direction While there is little doubt that occasionally in a patient who has been treated conservatively, the kidney or a stone may have to be removed at a later date, nevertheless, it is not always necessary to operate on a patient with a transcapsular rupture of the kidney Shock must first be controlled, and an excretory urogram should be done as soon as possible Jones (1955) recommended that if the pyelographic pattern is not clear, a retrograde pyelogram should be done immediately This is not generally accepted since minor injuries may temporarily cause marked interference with function The indication for surgery really depends on the patient's clinical condition rather than on the radiological appearance in the early stage If this condition deteriorates, and if there is a spread of rigidity or increase in a swelling in the loin, obviously the earliest possible surgical intervention is necessary.

Hydronephrosis

Much work continues to be done in the study of hydronephrosis There are several possible routes of reabsorption in the obstructed kidney and the possible pathways for reflux include pyelovenous backflow, pyeloglomerular backflow and pyelolymphatic backflow

Persky, Bonte and Austen (1956), employing isotopic tracer materials, have shown that particles gain rapid access to the blood stream, and they consider that a fairly direct shunt exists between the pelvis and the blood stream By experiments they have demonstrated that in the dog, pyelotubular and pyelo-interstitial routes of backflow occur early No direct vascular shunt was demonstrated In line with this, Goodwin and Kaufman (1956) suggested that renal lymphatics, which are known to be quite abundant, act as a safety valve or protective mechanism in diuresis and under conditions of ureteric obstruction. They have shown by a series of experiments, that the thoracic duct lymph flow is increased under diuresis or ureteric occlusion or both They consider that this lymph is elaborated in the kidney

Survival of kidney grafts

Much experimental work has been done on the survival of kidney grafts. In humans, both donor and recipient must be uni-ovular twins. In animals, a kidney homograft has been transplanted to the anterior eye chamber or brain and after stromatization transplanted elsewhere in the body. Reciprocal homografts have been exchanged between albino rats in continuing successful parabiosis (Greene, 1956). It is probable that the process of homografting is one of biological acceptance or rejection Kamrin (1956) has shown that kidney tissue from unrelated albino rats can be homografted to the kidneys of albino rats which have been separated from the state of successful parabiosis. The intraperitoneal injection of donor kidney tissue homogenate into the recipients results in a greater reaction in the graft and a lesser reaction in the host tissues.

Surgical technique

Khoury (1956) described a simple technique to determine, at the time of operation, the area of kidney supplied by a lower polar vessel. He injected 7 millilitres of indigo carmine, through a small hypodermic needle, directly into the vessel; the renal parenchyma supplied by the artery turns a deep blue, which lasts for several minutes, and gives a sharp line of demarcation. This, of course, is much more accurate and is quicker than temporarily occluding a vessel to produce ischaemia. It is also much simpler and less dangerous than a preliminary renal arteriogram.

Kidney biopsy

This is considered by some to be a valuable adjunct in the treatment and study of certain renal diseases, such as the hypertensive kidney, nephrosis, nephropathy associated with diabetes mellitus, renal disease occurring in eclampsia, chronic pyelonephritis, and acute renal insufficiency. Contra-indications include a known bleeding tendency, suspected malignancy, and tuberculosis or perinephric abscess A biopsy, of course, should only be done when a diagnosis cannot be made by other means.

Operative method

Parrish and Howe (1956) reviewed 100 needle biopsies; a Turkel liver biopsy needle is used. An intravenous or retrograde pyelogram is done to locate the kidneys. The skin is prepared with an antiseptic solution, the area is infiltrated with local anaesthetic, and a small skin incision is made. The Turkel liver biopsy needle, consisting of an outer needle and stilet of 11 gauge (100 millimetres long) with an inner trephine needle and stilet 13 gauge (150 millimetres long) is introduced. The needle is directed perpendicular to the curve of the flank and in the horizontal plane. As the trocar passes through the fascial layers, a definite snap is felt when the lumbodorsal fascia is penetrated. Almost immediately after this, the needle should encounter a solid mass, which is the kidney. It is pushed into the kidney substance for a few millimetres, a 20 cubic centimetre syringe is attached and [illegible] With this pressure maintained, the needle is advanced for [illegible] [illegible]taining the negative pressure, [illegible] n reaches the skin, a small portion of renal tissue is [illegible] series of 100

of cases, the blood pressure had been reduced to 140/90, or below, for at least a year. This demonstrates that unilateral renal disease can cause hypertensive disease in man The cause of this hypertensive vascular disease remains unknown. On the present evidence, the kidneys perhaps cannot be indicted: arterial disease appears to be the primary cause. The theory of Goldblatt's experimental hypertension is at present in a state of flux. Of all patients with diastolic hypertension probably less than 2 per cent are candidates for therapeutic renal surgery. Patients must be followed for a minimum period of one year, and the diastolic pressure should be reduced to or below 90 millimetres of mercury, with the systolic pressure below 140 before they are classified as cured Where unilateral renal disease is responsible for hypertension it is to be anticipated that the responsible kidney will generally be discovered by careful and critical investigation by ordinary urological methods. As Smith said, the urologist may well find himself pressed to intervene surgically against his better judgment. Whilst retaining a conservative outlook, he should not be obstructive and must remember that the certain proof of the part played by unilateral disease can only be found after nephrectomy which must remain an experimental procedure.

Spontaneous renal infarction

It would appear that spontaneous renal infarction is a definite but rare entity. There are three types recognized: (1) ischaemic, (2) haemorrhagic, and (3) combined. Arterial infarcts are ischaemic, while venous infarcts are haemorrhagic. Combined infarcts are caused by simultaneous arterial and venous thrombosis. Thrombosis of the renal veins generally, although not always, differs in adults and in children.

In infants

In infants, particularly the newborn, thrombosis of the main renal vein is associated with massive haemorrhagic infarction of the kidney. It has been observed in infants associated with severe diarrhoea and dehydration The thrombus is usually confined to the main renal vein. Demonstration of a non-functioning or poorly functioning kidney by intravenous pyelography makes the diagnosis almost certain Operation should be performed as soon as the patient can withstand the procedure, and by this means a spread of thrombosis to the inferior vena cava may be prevented and the patient saved by prompt nephrectomy Traggis and Ellison (1956) described a case in a boy, aged 17 days, of spontaneous thrombosis of the renal vein.

In adults

In adults, thrombosis of the renal vein generally produces a clinical picture of a nephrotic syndrome, and albuminuria is a constant feature

Aneurysm of the renal artery

When an aneurysm of the renal artery is discovered it is usually necessary to do a nephrectomy It may, however, occasionally be possible to perform a conservative operation and Pitkanen (1955) reported a patient in whom the aneurysm was resected, the continuity of the renal artery restored, and 8 months later radiographs revealed a good renal function without any hypertension.

Intermittent hydronephrosis

Intermittent hydronephrosis as a cause of abdominal pain may be very difficult to demonstrate since normal pyelograms do not necessarily exclude this diagnosis Persistent dilatation of the renal pelvis, of course, does mean that there is a continuing obstruction but, as a rule, the mechanism which causes intermittent dilatation is an aberrant vessel or a fascial band which may only occasionally cause complete obstruction. It is possible for a pyelogram to be perfectly normal between attacks and yet for complete intermittent obstruction to occur in that kidney. Nesbit (1956) recommended examination during an attack of pain, and demonstrated an extreme case where the dilatation occurring during the attack was quite gross. As he stated, the diagnosis of hydronephrosis can sometimes be made only under these conditions and certainly cannot be excluded except in these circumstances.

Intubation

Gibson (1956) believed that there is still a considerable division of opinion as to the use of splinting or intubation and nephrostomy following a plastic operation for hydronephrosis. It has been demonstrated that the ureter can regenerate all its coats even after extensive longitudinal defects have been created. Splinting or intubation has been considered by many to be necessary and stimulating to this process of regeneration. Hamm and Weinberg (1956) suggested that this was necessary in the majority of cases but that prolonged splinting also causes foreign body reaction with fibrosis in the wall of a ureter It probably increases the risk of infection, and, of course, eliminates for the time being the normal beneficial hydrodynamic effect due to the passage of urine over the healing ureter. Gibson considered that where there has been a disruption or complete destruction of the ureter, with lack of continuity, then splinting may be necessary. The present author would agree that it is better employed when there has been marked inflammatory reaction in and about the pelvi-ureteric junction secondary to peripyelitis and peri-ureteritis, but otherwise he does not think that a splint and drain are necessary. When a splint is employed a nephrostomy must also be established and both splint and drainage tube must always be removed at the same time. Many urologists who have favoured the method of Davis, which consists of simple linear incisions with intubation and no sutures, are changing over to the elliptical anastomosis of Anderson and Hynes.

THE CARDIOVASCULAR SYSTEM AND UROLOGY

Hypertension

As Smith (1956) said, "at the present time, nephrectomy even though very limited in its applicability would appear to be the only permanent cure for so-called essential hypertension". He reviewed the position of unilateral nephrectomy in hypertensive disease and found it a very much more common procedure than is the experience of most physicians and urologists in Great Britain. He noted that 575 unilateral nephrectomies had been performed in hypertensive patients with demonstrated or suspected unilateral impairment of renal function. In 26 per cent

claimed that the symptoms from chronic tuberculous cystitis were markedly improved in most cases by the use of this medication as a bladder irrigation As the irrigations are moderately irritating they have to be given several days apart.

Sterilization

They raised the question of sterilization of cystoscopes and found that immersion of a clean cystoscope in a 10 per cent formalin solution for 5 minutes proved to be an efficient and harmless method of sterilizing an instrument contaminated by tuberculosis In Great Britain, boilable cystoscopes are obtainable and should always be employed The instrument is thoroughly cleaned and boiled after use

URINARY LITHIASIS

Much attention has been given to the aetiology of the formation of renal calculi. [illegible]

soil and climatic conditions

An interesting study on the effect of temperature, humidity and dehydration in regard to the formation of renal calculi has been made by Prince, Scardino, and Wolan (1956). The chief stone-forming areas in the United States of America are thought to be in the south-east, southern California, and around the southern part of the Great Lakes. In Savannah 14 per cent of patients requiring urological out-patient treatment attended either on account of renal colic or nephrolithiasis. In the hot months from May to September 922 cases of acute renal colic were found to occur. The calculi were most commonly composed of calcium oxalate or calcium phosphate *Urinary infection was rare and the urine was usually acid*

Prevention of recurrent calculi

Urinary calculi recur quite commonly, varying from 15 per cent with calcium oxalate stones to over 50 per cent in the stag-horn dendritic type of calculi, associated with infection Because of this high rate, much work has been carried out to try to prevent recurrence, but so far without much success. Glucuronides increase the solubility of calcium phosphates Prien and Walker (1956) have administered salicylates for the purpose of increasing the glucuronides in the urine. 2 grammes of acetylsalicylic acid or salicylamide were given daily to 19 patients over a period of some 2 years It was found that the glucuronide excretion was increased up to four times and during the period under treatment 17 of the 19 patients were either free from recurrence of stone, or any stone which already was present had not increased in size In one case, there was a slight increase in size of an existing calculus, and in one there was a recurrence

Treatment with aluminium hydroxide

Aluminium hydroxide has been given by mouth, to prevent recurrent renal calculi The principle underlying this treatment is simple. Aluminium hydroxide reacts with phosphates in the food, precipitating them in the alimentary tract as

THE ILEUM IN UROLOGY

Much work has been done in trying to improve the results of urinary diversion This has for the most part entailed employment of part of the alimentary tract either as a conduit or to enlarge the bladder. Redirection of the urinary stream to an isolated ileal loop was probably first used by Bricker (1950) who formed a conduit to which he anastomosed the ureters after pelvic exenteration. When it is necessary to include the bladder in an exenteration, for the removal of pelvic disease, urinary diversion becomes absolutely necessary. It is probable, however, that by the time such urinary diversion is indicated, malignancy cannot be irradicated but will recur even after the most extensive surgery. Urinary diversion in this instance, therefore, must be listed as a palliative procedure It may, however, be employed as part of a curative operation and not always be associated with malignancy.

Ileal ureterostomy

At the Annual Meeting of the British Association of Urologists in 1956, Wells *(1956) reviewed a series of 212 cases in which a loop of the ileum had been used* as a conduit and the patient left with a permanent ileostomy. He drew attention to the dissatisfaction many have with the results of uretero-colic anastomosis. In this operation there are three main risks· first, a reflux and ascending infection; secondly, stenosis at the site of the anastomosis; and thirdly, a biochemical imbalance which is usually an acidotic hyperchloraemia. The pre-operative preparation for the ileal operation is comparatively simple and less than is necessary for uretero-colic anastomosis because the faecal stream is liquid in the ileum and the bacterial count is less in this part of the bowel than in the colon.

The operation

Sulphasuccidine, 12 grammes, is given each day for 5 days, and the bowel is washed out on the morning of the operation The peritoneal cavity is opened through a left paramedian incision and the abdomen is searched for the presence of metastases which might be a contra-indication for the operation. The bowel is packed off and the ureters are exposed just proximal to the bifurcation of the iliac vessels The ureters are lifted from their bed from this point down to the bladder, and each is divided as close to the bladder as possible. The distal end of the ureter is ligated, and the proximal end catheterized with a ureteral catheter. There is no contra-indication to transplanting dilated ureters into an ileal loop The point of selection for the ileal conduit should be approximately 7–8 inches from the ileo-caecal junction this preserves an artery which is vital to the ileo-caecal junction. The length of the conduit will depend on its purpose and may be from 8 to 18 inches in length The longer loop is easier to work with, although there is some evidence to show that a conduit of over 8 inches will provide a large enough area of absorption to permit an electrolytic imbalance. The mesentery of the lower ileum is inspected in order that a proper vascular supply should be demarcated for the loop selected The arcade arrangement of the arterial supply is well adapted for the procedure A vascular pedicle which will give an adequate supply to the whole of the conduit is selected, and the exact point of resection and re-anastomosis

highly insoluble aluminium phosphate. Phosphorus absorption is thereby diminished, and consequently less phosphate is excreted in the urine. Pyrah (1956) and his co-workers described a new preparation of aluminium "Hyalgel", which is sufficient to reduce the urinary phosphates. Of 27 patients who were selected for trial, calculi were bilateral in 20 and unilateral in 7. Twenty-three of the patients had undergone operations amounting in all to 61 interventions: between them they had also voided 29 stones. Patients likely to benefit most are those who have previously formed stones which are known to have been phosphatic. During the treatment, frequent laboratory tests were made to confirm that urinary phosphates were being kept low. Only 3 patients failed to respond favourably to the correct dose of Hyalgel. It is only rarely that stones diminish in size or disappear during this treatment. This is very unusual, but the greatest application of the treatment is in order to prevent the reformation of stones in known phosphatic stone formers after operation has rendered them stone free. Albert and Rees (1955) have shown that certain antibiotics become firmly bound to the aluminium hydroxide in the gut if the two are given together by mouth It follows, therefore, that an antibiotic and an aluminium preparation should not be given at the same time.

Treatment of calculous disease

Before considering the treatment of a case of calculous disease of the kidney a complete investigation is always advisable. In patients in whom a calculus is rapidly increasing in size, and when there is recurrent lithiasis, this is especially necessary. Primary hyperparathyroidism, the so-called milk-alkali syndrome, multiple myelomatosis, renal acidosis, renal rickets, hypervitaminosis, Boeck's sarcoidosis, and Paget's disease must each be ruled out. The renal function also is estimated. The urine is cultured, to exclude infection, and tested for Bence-Jones protein An excretory pyelogram is always carried out, cystoscopy, and, rarely, a retrograde pyelogram may be necessary Radiographs of the chest and a full biochemical study is always made. The latter should include blood calcium, inorganic phosphorus, serum globulin and albumin and the alkali phosphatase. It may be important to assess whether or not there is hypercalcinuria. The patient is given a measured calcium intake and the 24-hour excretion of calcium is determined. If infection is present, sensitivity tests are made and the appropriate antibiotic or other therapy is given to control it

It may not always be necessary or even advisable to operate for calculous disease of the kidney, and the optimal time for intervention is based largely on clinical judgment As a general rule, the more severely damaged kidney should be dealt with first when stones are present on both sides and when there is impairment of renal function To be successful the operation must include complete removal of all calculi together with the provision of free drainage within the urinary tract. When at all possible stones should be removed through an incision in the renal pelvis; incision into the parenchyma is avoided in order to preserve functioning renal tissue When the substance of the kidney has to be incised, bleeding may be controlled by a rubber tourniquet placed around the renal pedicle and released at 10-minute intervals, by a clamp, or by digital pressure on the hilum Any large spurting vessel is sutured; partial nephrectomy, especially of the lower pole, is often necessary.

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can then be easily determined. Bowel forceps are placed on the proximal and distal points selected in slightly angular fashion in order to remove rather more of the antimesenteric wall of the bowel The bowel is divided and the resection is carried down into the mesentery, both anteriorly and posteriorly, in a V-shaped manner towards the vascular pedicle. Any vessel which has to be divided can easily be seen, and is picked up and ligated. The conduit is laid aside under a moist pack in order that time may be gained to determine whether or not the incised section of bowel is adequately supplied with blood The continuity of the ileum is now restored. At first, the author employed end-to-end anastomosis but on the whole is more satisfied with a side-to-side anastomosis.

The method of implant is of some importance There seems little doubt from Wells' figures that a mucosa-to-mucosa anastomosis is, in the long run, a better method than the direct implantation of Stiles or Coffey, and also better than when the ureter is pulled through for a distance of 1–2 centimetres, on a catheter, into the lumen of the bowel. Annis (1956), however, pointed out that the mucosa-to-mucosa anastomosis is more liable to produce post-operative complications, usually because there is a greater liability to leakage and to paralytic ileus.

Having performed the anastomosis of the ureters into the bowel, the terminal portion of the ileum is brought out through a McBurney type of incision in the lower part of the right iliac fossa, an ellipse of skin is excised and this aids in preventing stenosis of the ileostomy The ileum should not be stitched to the skin because this encourages the formation of a fistula or subcutaneous abscess in the area.

Post-operative care

Post-operatively, most of the patients show some form of paralytic ileus. It is good practice to give nothing by mouth until the bowel sounds are easily auscultated, which usually occurs within 2–3 days During this period, the patient receives the necessary fluid and salts intravenously.

Results of ileal ureterostomy

Annis reported a series of 58 patients who had an ileal ureterostomy where formerly a uretero-colic anastomosis would have been performed. Of these patients, 43 had carcinoma of the bladder, and in 41 the operation was combined with total cystectomy. The mortality rate amongst the 58 patients who had ileal ureterostomy was 29 per cent, and amongst the 41 who had a total cystectomy it was 25 per cent. This is, of course, a very high proportion, but many of the patients were old and were poor operative risks The incidence of post-operative complications was also very high. Amongst those who recovered 18 had complications; there were 5 cases of urinary fistula, 3 of whom recovered spontaneously, 4 patients with burst abdomens and another 4 with ileus. On the credit balance, however, there was only 1 patient who developed pyelitis, and after recovering from the hazards of the operations the general well-being of the patients was extraordinarily good Almost all who survived were comfortable and happy

Anastomosis comparisons

An interesting comparison was made between three types of anastomosis In 14 kidneys operated on according to the Stiles and Coffey method 9 were unchanged.

1 was improved, 1 continues to have no function, and 3 were worse. In the pull-through anastomosis employing a catheter, 2 cases were improved, 7 were unchanged, and 3 were worse. With the mucosa-to-mucosa anastomosis 16 cases were improved, 24 were unchanged and only 4 were worse. Whether the increased

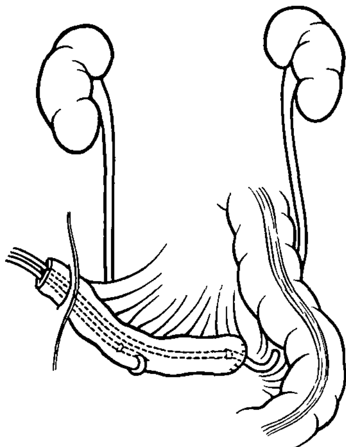


FIG 31.—Anastomosis of the ureters into an ileal loop by the pull-through method Note that the left ureter is brought through the mesocolon

risk of leakage which is liable in a mucosa-to-mucosa anastomosis, with the accompanying complications of ileus and fistula, warrant this method because of the improvement in kidney function will remain to be seen when larger series of cases have been collected.

Avoidance of renal infection

The almost complete avoidance of renal infection when an ileal loop conduit is employed has a considerable effect on the general well-being of patients. If, however, the kidneys have been subject to infection before the ileostomy, this method of drainage does not necessarily mean that further infection may not occur. There is, however, practically no biochemical imbalance, especially if the loop is short, and this, of course, is a great advantage of the method

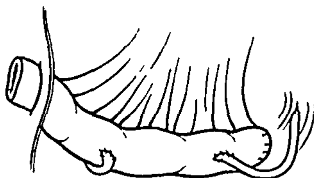


FIG 32.—Anastomosis of the ureters to the ileal loop with direct end-to-side anastomosis.

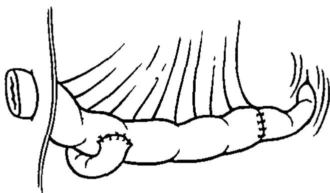


FIG 33.—Anastomosis of grossly dilated ureters into ileal loop Left side—end-to-end, right side—end-to-side.

Ileal loop in congenital disease

There is one disease in which the use of the ileal loop can be very strongly advised and that is where some form of congenital spinal palsy has resulted in urinary incontinence. Severely crippled children must always wear some sort of orthopaedic appliance to become ambulant and if they are incontinent of urine this may become quite impracticable. Skin and vulva ulceration may be unavoidable and rubber urinals are too much for the child to manage.

Nash (1956) reported 10 patients, ranging in age from 6 to 22 years, in whom ileal loops were used as conduits. Nine of these cases had already had operations on the bladder in an attempt to control their incontinence. All these children had suffered serious and prolonged interruptions in their education. Following operation the general condition of each child improved beyond recognition They gained weight, and are thrilled with their new hygiene. "All the children are now having full-time education, two of them are attending ordinary day-school, the two other girls are mobile and dry, and both gainfully employed "

Rickham (1956) also discussed the use of the isolated ileal loop in paediatric surgery and reported 6 children in whom this was used in *ectopia vesicae and*

epispadias. Whilst there are few recorded successful plastic repairs for ectopia vesicae this method is still being employed, and as time is on the side of the child, probably some form of plastic operation will still be attempted as a first line of attack in most paediatric urological centres In considering ileostomy for these tragic congenital dysfunctions we must always remember Grey Turner's very good results with ureterocolic anastomosis The long-term results of his operation, which was essentially a simple one, before the days of antibiotics, were on the whole very successful. The author can remember him showing 3 patients who had been operated on for upwards of 25 years, and 2 of them were grandmothers Most urologists must have a number of cases carefully and well-controlled by ureterocolic anastomosis and Rickham's analysis of 15 children on whom this operation had been performed with only one becoming reasonably normal, must be a very pessimistic and unusual experience.

Ileal loop in reconstructive surgery

Besides replacement of the bladder after cystectomy, an ileal loop may be used in many reconstructive operations. It can be used for enlarging the bladder and there is no doubt that in occasional cases, of contracted bladder either from tuberculosis or interstitial cystitis of the Hunner type, this may be a most helpful operative procedure The operation is a major procedure and success will depend upon careful and meticulous technique

In ileocystoplasty, there are various ways of applying the loop of ileum. Several

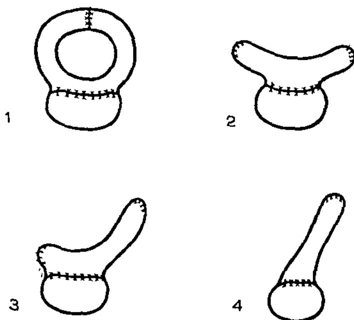


FIG 34.—Ileocystoplasty · (1) ring method of Steele, (2) symmetrical application, (3) asymmetrical application, and (4) "cat's tail" method.

continental workers think that the ring plastic operation of Scheele (1922) gives such good results that this is the only method to employ. In Great Britain and in America, the loop is more often than not applied almost symmetrically to a wide opening in the bladder with both ends closed. It may be that the size of the opening is more important than the actual relation of the loop itself. Hanley (1956) has observed the functioning of these loops with the image intensifier, and he suggests that the proximal end of the loop should be closed and the distal end anastomosed to the opening in the bladder in the so-called "cat's tail" method. In the author's experience a symmetrical anastomosis with a very wide opening has given favourable results. Before contemplating ileocystoplasty in tuberculous cases, it is important to prove that the disease is quite inactive The author had good results in Hunner's ulcer, and whilst no case has been completely cured, they have all been so greatly relieved as to make the operation well worth while. The continued contact of urine with the ileum following ileocystoplasty does not produce a biochemical imbalance Pyrah has previously shown experimentally, that when isotopes of chloride and sodium are in contact with the mucosa of the ileum there is a two-way transport of both ions With normal kidneys the balance should remain satisfactory. He has also reported occasional trouble from the formation of mucus in the loop. It is, however, unusual for this to be significant.

The loop of ileum can be used as replacement of part of the ureter. We should always remember that this should never be done as a surgical exercise and if a ureter can be reimplanted in the bladder, the result is almost always more satisfactory, and is likely to remain permanently so, than when a loop of bowel has to be used as a bridge or aqueduct

CARCINOMA OF THE PROSTATE

Despite intensive studies the problems associated with carcinoma of the prostate are still many On the early diagnosis of active carcinoma of this gland depends the chances of surgery extirpating the disease The presence of histological carcinoma, however, does not necessarily mean either that it is active or that it will become so The correct histological interpretation of a prostatic nodule is very important but is not the only guide in the management of the case.

Diagnosis

Rectal palpation.—When performed by a skilful finger rectal palpation is undoubtedly the most valuable diagnostic means, and the significance of palpable prostatic nodules is a most important urological problem Jewett (1956) studied 211 localized abnormally indurated prostatic nodules, histologically, 108 were benign and 103 were malignant Most of the patients were aged over 40 years He found that no gross characteristics were consistently reliable for distinguishing benign from malignant nodules

Cytological examination of the prostatic excretion.—This is obtained by massaging first one lobe and then the other, requires a good deal of experience, offers uncertain results in a large percentage of cases, and is especially disappointing in early carcinoma of the prostate.

Transrectal biopsy of the prostate.—Transrectal biopsy was introduced by

Astraldi in 1937 and has obvious defects, the most patent of which is the risk of infection. Grabstald (1956), while advocating the transrectal approach, mentioned two cases of fistula following subsequent retropubic prostatectomy. He summarized the results in 51 cases and advocated a delay between biopsy and definitive surgery of from 3 to 6 weeks

Transurethral biopsy.—This rarely yields reliable results in the diagnosis of neoplasia in its early stages, since the fragments obtained come from the central area of the prostate on the side of the urethra whereas, as Franks (1956) has shown, neoplastic nodules are generally found in the posterior and more eccentric portions Open surgical biopsy is undoubtedly the most reliable means of diagnosing a cancer in its early stages, especially since 90 per cent develop in the posterior lobe.

Transperineal needle biopsy

Bianchi (1956) surveyed the method and the results in 82 patients using the Silverman needle. The patient is placed in the lithotomy position, the scrotum is lifted and the perineum is carefully disinfected. Under intravenous anaesthesia, the needle is inserted 1 or 2 centimetres anterior to the anal orifice keeping either to the right or to the left of the raphe according to which lobe is to be biopsied. The needle is guided along the rectal wall using a finger in the rectum The needle is gently advanced to the suspected area care being taken not to injure the urethral bulb, the peribulbous vascular system, as well as the bladder and the rectum. When the needle has thus reached the suspicious nodule, the mandrin is withdrawn and the cutting needle is introduced With a slight pressure, it is advanced farther and rotated in either direction until the specimen is obtained In only 5 of the 82 cases was the specimen obtained inadequate for a reliable diagnosis The diagnosis on prostatic biopsy was confirmed in 94·6 per cent of the cases It is interesting that in 88 per cent of these cases, the correct diagnosis was made by digital examination. On the other hand, a diagnosis of cancer of the prostate was made by needle biopsy in 9·7 per cent of cases thought to be negative on rectal palpation.

Surgical treatment

Jewett considered that exposure of the entire posterior surface of the prostate gland by the perineal approach afforded the greatest accuracy in identification and excision of the indurated portion for histological examination. He made the statement that if the cancer is localized in the prostate and a radical perineal prostatectomy is carried out, the survival rate will be 50 per cent. Kimbrough (1956) is of the same opinion He observed that if clinical symptoms are present, only 5 per cent of cases of carcinoma are amenable to surgical cure. He considered that radical surgical extirpation is indicated when the malignant process has not extended beyond the capsule of the prostate or seminal vesicles, or encroaches on the membranous urethra as demonstrated by rectal palpation During the 11-year period 1940–50, 100 patients with carcinoma were treated, 56 by radical surgery, and 44 by palliative methods. Oestrogen therapy will reduce the size of the nodules and lessen the hardness in 80 per cent of cases. Of the patients treated by radical surgery 36 (64 3 per cent) are living and well at the end of 5 years

Atherton and Atherton (1956) considered radical perineal prostatectomy the

operation of choice for the small prostate with early carcinoma, but when there is a considerable amount of benign hypertrophy associated with the carcinoma, they believe the retropubic approach is better. Large prostates can be removed more easily in one mass, with the attached seminal vesicles and the bladder neck, through the retropubic approach. The bladder neck can be anastomosed to the first part of the urethra. The follow-up in their cases is not sufficiently long to be of any great significance If retropubic radical prostatectomy is to be performed, it may be that transperineal needle biopsy should be made.

Conservative treatment

The conservative treatment of carcinoma of the prostate is discussed by Pool and Thompson (1956). They stated that carcinoma of the prostate gland can seldom be detected early enough to permit radical surgical treatment, and say that 90–95 per cent of patients must be treated conservatively.

In the period 1926–36, 27 per cent survived for 5 years or more, whereas from 1942–46 the survival rate had gone up to 39·2 per cent on account of oestrogens being administered The removal of less than 30 grammes of tissue was sufficient in most patients to relieve urinary obstruction. Ganem (1956) reported a 5-year survival of 45·7 per cent of 90 patients without bone metastases treated conservatively, and a similar survival rate in 12·7 per cent of 49 patients with bone metastases.

Inoperable prostatic carcinoma has been treated by the injection of radioactive gold in several centres in the United States of America. It is very difficult to evaluate the therapy as in most series the patients have been castrated and received oestrogen as well. Bulkley, Cooper and O'Connor have treated 44 patients with carcinoma of the prostate with radioactive gold, with chromic phosphate and with yttrium (Bulkley, 1956). They are not very enthusiastic or optimistic. One half of those treated with gold received some benefit, 5 treated with chromic phosphate had serious blood complications.

Biochemical findings

Much work has been done in evaluating the significance of the serum acid phosphatase levels in carcinoma of the prostate Unfortunately, it is of very little help in the clinical management of the case, although high levels indicate a poor prognosis.

Hill (1956) compared the incidence of elevated total serum acid phosphatase with elevated prostatic serum acid phosphate in patients having localized untreated prostatic cancer. The findings in 44 men suggested that prostatic serum acid phosphatase is probably a more sensitive indication of liberation of prostatic secretion into the blood stream than the total serum acid phosphatase, but it has not been conclusively proved that it is helpful in diagnosis. At Cornell University Day and his colleagues (1956), working in a cancer prevention clinic, determined the total and prostatic serum acid phosphatase levels in 366 men between the ages of 20 and 79 years. In 15 of the 366 patients some elevation of the prostatic portion of the serum acid phosphatase was found on their first visit In 10 of these who had subsequent determinations, the value was normal It may be that physiological or psychological stimuli produced the initial high level. They concluded that increased prostatic acid phosphatase levels may be found in 4 per cent of the population, but that these levels may not be maintained There is no evidence that these

evanescent elevations are pathologically significant, although the patients have so far been followed for periods of only 6–18 months.

Ganem (1956) reviewed the prognostic significance of elevated serum acid phosphatase level in advanced prostatic carcinoma; the 5-year survival rate varied widely from 59 per cent to 0 per cent depending on the presence or absence of hydronephrosis, bone metastases, and an elevated serum acid phosphatase. All of the 145 cases which were studied had been treated by bilateral orchidectomy, followed by oestrogen administration, usually stilboestrol 5 milligrams daily. An elevated acid phosphatase level in patients with bone metastases is a poor prognostic sign when treatment by bilateral orchidectomy and stilboestrol has been instituted. It promises a lesser chance of 2-year survival.

SCIENCE AND CLINICAL UROLOGY

It is always interesting to note the application of scientific developments to clinical work in diagnosis and treatment. In a review of the application of ultrasonic energy Craig-Coates (1956) described a series of experiments using electron tube oscillators of varying frequencies as generators, and quartz or ceramic crystals of varying frequencies and shapes as transducers By applying ultrasonic energy to urinary and biliary calculi, some changes have been produced which suggest that this method would be capable of distintegrating calculi. The changes seem to consist of a rearrangement of particle constituents so that the calculus becomes more easily crumbled than before treatment. He does not consider it a practicable proposition at the present time, since the amount of sound power necessary to produce significant changes in calculi in the kidney or bladder when applied at the body surface is so great that severe damage to the intervening tissue is certain. It would be necessary to introduce the power through an instrument like a cystoscope. Lamport and Newman (1956) are working on such an instrument. They have also developed an ultrasonic drill or lithotresor which has been used experimentally on stones introduced into the ureter in a cadaver In 12 experiments with their lithotresor in the upper ureter, the results were as follows·

Fragmented or drilled through the stone	3
Drilled part way through the central zone, stopping for extraneous reasons	4
Grooved and by-passed the stone	5

They are rather optimistic that they may be able to apply ultrasonic lithotresis to the living person, and thereby remove impacted ureteral stones from farther up the ureter than is now the case with less hazard and with more consistent success Clinical application must await the outcome of further cadaver studies and probably of animal studies to determine the safety of the method.

Burke (1956) described a new, small, light-weight portable radiographic unit in which the source of energy is a radio isotope ^{170}Tm. The advantages claimed for this unit are its small size and complete mobility, there is no electrical attachment and therefore no explosion hazard. Being so small the whole unit can be encased in a sterile plastic sleeve. The initial cost is low and the unit can be readily available in other than a proper operating room The principal disadvantage of such a unit is the need for periodic replacement It is at the present time rather in the nature of what in America would be called a "gimmick".

ABSTRACTS RELATING TO PROGRESS IN GENITO-URINARY SURGERY

Acute anuria

Management

In a discussion on the management of acute anuria, STIRMAN (1956) points out that decreased renal function is readily reversible if oligaemic shock is adequately treated. Difficulties may be encountered, however, if a haemolytic transfusion reaction is superimposed or if there are fluid and electrolyte abnormalities. A patient suffering from shock due to loss of extracellular fluid should be given an infusion of a balanced salt solution. Animal experiments have revealed that whole blood therapy is less effective in the treatment of this type of shock. A balanced salt solution, such as Hartmann's solution, is similar to extracellular fluid in ionic composition and concentration. The clinical features of a deficit in the volume of extracellular fluid are as follows: somnolence, loss of elasticity of the skin, a wrinkled but moist tongue, tachycardia, either oliguria or anuria, and an increase in the amount of blood-urea nitrogen. Water intoxication may develop when a non-salt-containing fluid is administered in the management of this condition. The manifestations of water intoxication include headache, blurred vision, a rise in blood pressure and convulsions. Either water given by mouth or a glucose solution administered intravenously effects recovery in cases of functional anuria due to a restricted intake of water. If treatment is inappropriate a functional anuria may be converted into an organic anuria. Exogenous potassium and protein must be omitted in the management of organic anuria. The intake of water and sodium should be restricted, but at least 100 grammes of carbohydrate should be given daily. At the same time, attention is directed towards the prophylaxis or active treatment of abscess, haematoma or necrosis. Artificial haemodialysis may be employed in order to counteract hyperkalaemia, acidosis, electrolyte dilution and deterioration in the clinical condition. A tendency to bleed is the only contra-indication to this method of treatment.

Post-nephrectomy renal failure

Case report

MCGEACHY, BLOOMER and MERRILL (1956) describe post-nephrectomy renal failure in a patient, aged 71 years, with a normal pre-operative blood non-protein nitrogen. She had a history of pyuria. On admission, the blood count was normal and blood NPN 28 milligrams per 100 millilitres, creatinine 1.2 milligrams per cent. On cystoscopy, turbid urine was obtained from the right kidney, which was moderately ptotic, with a dilated pelvis. Nephrectomy was performed. The urinary output the following day was 965 millilitres. After 2 restless nights, she was incontinent and drowsy; and after 4 days the drowsiness increased and Cheyne-Stokes breathing occurred. Blood non-protein nitrogen (NPN) was 33. Following blood analysis, she received 400 millilitres of sodium chloride, with potassium chloride, 1 gramme, intravenously and within 4 hours was much more responsive. The next morning her blood bicarbonate was 21.8, chloride 87, sodium 123, potassium 3.3 milliequivalents per litre, sugar 132 milligrams and NPN 36 milligrams per 100 millilitres. Respirations were laboured, the tongue was wrinkled, "fingerprint" oedema was present, and the muscles were flabby. After repeated infusions of sodium chloride, she excreted 1,720 millilitres of urine. Her clinical condition and blood analysis now began to improve and, 2 weeks later, she was discharged. The condition was one of renal tubular insufficiency, with chronic acidosis. Severe electrolyte depletion responded to replacement. Pyelonephritis probably explained the abnormal tubular function with normal blood NPN. Renal function tests in addition to blood NPN determination are indicated before operation is undertaken.

Intrarenal arteries

Anatomy in health and disease

The anatomy of the intrarenal arteries in health and disease is described by GRAVES (1956). The segmental arrangement of the vessels is constant and there is no collateral arterial circulation between the segments. The renal parenchyma is divided into apical, upper, middle, lower and posterior segments, each supplied by its own artery. Before entering the hilum, the renal artery divides into an anterior and posterior division, branches of the anterior supplying the upper, middle and lower segments, the posterior continuing to the posterior segment Arteriography has confirmed the absence of a collateral circulation between the segments and has also demonstrated the delicate pattern of the finer arterioles, an important factor in distinguishing them in health and disease. The intrarenal veins have no segmental arrangement but a free anastomosis throughout the kidney. The so-called aberrant and accessory arterioles are almost certainly normal segmental arteries of precocious origin from the main stem, a significant concept in surgery, since ligation leads to necrosis. The intrarenal vascular pattern in cysts and tumours is examined in respect of the potential value of angiography in the differential diagnosis Aortography is becoming an established procedure, and many cases are reported in which a carcinoma of the renal parenchyma is indicated by "pooling" of the radio-opaque dye believed to be lying in abnormal tumour vessels, as noted in 1953 by Whitehead Other writers have shown that in contrast to neoplastic disease, a solitary cyst is indicated by absence of dye in any area of the cyst, which itself displaces the surrounding vessels In this study, the area occupied by the cyst was avascular, but the segmental arterial pattern was undisturbed, while the cortical pattern was normal and extended to the edge of the cyst The appearances of carcinoma were not as uniform: in 3 specimens, the tumour area was avascular with distortion or absence of the segmental vessels. in the two earlier growths, the cortical pattern adjacent to the tumour was absent. Since [illegible]

graphy must be of more value at operation than translumbar, a technique has been evolved by which the kidney is mobilized and the renal artery completely defined The details are described Five such arteriograms, including one segmental, have been made at operation, with successful results

Renal calcinosis

Case reports, aetiology

[illegible]

recurrent attacks of colic due to renal calculi. In the third case nephrocalcinosis developed in a man, aged 22 years, who was given large quantities of a calcium salt of *para*-aminosalicylic acid in the treatment of tuberculous meningitis. Slight haematuria and [illegible]

calcinosis may occur in cases of hypercalcaemia due to primary hyperparathyroidism,

hypervitaminosis D, Boeck's sarcoidosis, and diseases in which bone destruction takes place. The condition may also result from renal acidosis due to disturbance of the acid-base balance and from prolonged intake of milk and alkalis during the treatment of peptic ulcer. On histological examination of the kidney the calcium deposits are found in the epithelium and basal membrane of the tubules, in the walls of the renal vessels and in the interstitial tissue. Chronic interstitial inflammation may ensue and eventually a granular kidney may develop.

Two case reports

JAMES (1956) describes two cases of disease of the renal tubules with calcinosis of the kidneys. One was a boy aged 8 weeks who was admitted for vomiting and for failure to gain weight; he was born in a fourth pregnancy associated with mild toxaemia. The child was constipated but had no melaena. On admission he was badly shocked and gastro-intestinal bleeding or pyloric stenosis were thought possible; radiographs showed free regurgitation up the oesophagus in all positions. In spite of marked dehydration urination was frequent. A diagnosis of renal acidosis was then considered and a sodium citrate mixture was given. Intravenous pyelography showed normal excretion of dye. Despite early progress relapse occurred and the infant died after 12 weeks in hospital. At autopsy the whole colon was oedematous with a haemorrhagic mucosa, the lumen containing faeces and blood. The kidneys were externally normal but on section showed linear yellowish-grey deposits in the medulla. On microscopy extensive medullary calcification was noted but the cortical part of the kidney showed no glomerular lesion. An accidental finding of interest was calcification of the ejaculatory ducts of the prostate. The second patient was a boy aged 4 years who suddenly developed tetany and had a convulsion. He was given no solids until his thirteenth month; he had always had marked thirst. Up to his eighteenth month he had 5 attacks of vomiting, diarrhoea and fever and it was noted that his hands and feet were stiff and painful. Response to antibiotics was always quick and the significance of the condition of the extremities was overlooked. When seen in hospital he was fairly well nourished, had dry eczema, and carpopedal spasm with Chvostek's sign were recorded. Various laboratory and other investigations were made and radiographs showed areas of calcification in both kidneys, mostly in the medulla. Pyelography showed slight hydronephrosis on the right side. The bones were clear. This child recovered. A similar condition is recorded in adults.

Kidney tumours

Radiological diagnosis

WOODRUFF, JNR., and his colleagues (1956) discuss the roentgen diagnosis of renal neoplasms. In this study, retrograde pyelograms proved more helpful than excretory urograms, but either showing any abnormality were regarded as positive. In 7 cases, preliminary films and pyelograms or urograms failed to demonstrate a neoplasm. This failure is attributable to the smallness of the tumour or to its peripheral location; to superimposed hydronephrosis or extensive polycystic disease. Antegrade pyelography is useful in cases with poor function on delayed excretory urography, and in distinguishing neoplastic from non-neoplastic hydronephrosis. Aortograms, which were carried out in 9 cases, showed tumour vessels in 8 and indicated cortical carcinoma. Aortography discloses small tumours and haemangiomas; tumours undisclosed by pyelogram; those obscured by, or mistaken for, polycystic kidneys; and malignant extension into the renal vein. It serves to distinguish renal from extrarenal growths, benign from malignant, cysts from neoplasms. Its disadvantages are failure to show tumour vessels in certain growths, difficulties of precise time exposure, complications and mortality. Presacral air injection sometimes discloses a renal mass unsuspected on pyelography, and assists in distinguishing intrarenal and extrarenal lesions. The percutaneous puncture of renal cysts, combined with microscopic examination of aspirated content, contrast filling of the cyst, and aortography help to differentiate renal cysts and tumours; most urologists, however, prefer kidney exploration. One renal carcinoma in 14 is associated with cystic changes. Contrast filling of the inferior vena cava shows displacement and filling defects and obstruction at or below the renal vein with visualization of the collaterals.

Indications for partial resection

The indications for partial resection of the kidney infected by tuberculosis are discussed by MAY (1956). Until modern drugs were available there was always the possibility, in operating on a tuberculous kidney, that the wound might become infected. This risk was much greater if pus or infected urine could escape into the tissues and the mortality in nephrectomy for tubercle was about 10 per cent. With the introduction of streptomycin and the help of sanatorium treatment this figure fell to 1 per cent. When claims were first advanced for operation on the kidney and the opening up of its [illegible] tubercle some scepticism was felt, yet the author [illegible] Removal of a pole of the kidney is only good practi[illegible] has healed and the disease is limited to one or two [illegible] of chemotherapy is necessary. In the first operated [illegible] beneath the capsule but, since using the new [illegible] lesions. Furthermore, it is now quite common to [illegible] scars of healed tuberculous foci. Similarly a stenosis of the lower ureter and scar formation at the neck of the calyx or of a group of calyces is more often found. As the urine clears the tuberculous process recovers and cure is suggested, but it is important to remember that, locked up behind a contracted scar, there may be a collection of infected matter which, for a long time, will contain virulent bacilli. In May's experience 2 or 3 years may be needed before a tuberculous cavity heals and it is not possible, in radiological examination to decide which cavity has healed and which has not. The bladder must be kept under observation. The author describes a group of 31 patients in whom a pole of the kidney was resected. In 12 cases bilateral disease was present, 2 had already lost a kidney, 5 had bilateral operations and in another 5 the second kidney is still to be operated upon. There was one death, a patient in whom, against the advice given, one kidney had already been removed. In general, the long-standing foci are the most difficult to cure but the procedure described has proved its value.

Frequency, diagnosis and treatment

BORTHWICK (1956) discussed tuberculosis in the genito-urinary tract. He pointed out that it is only in recent years that this disease, found in the kidney or in the epididymis, was regarded as not present in isolation but rather as part of a systemic disorder. In this paper no reference is made to the female tract, but it is considered that the genital organs in the female are not infected from the urinary system. The number of persons now being admitted for pulmonary tuberculosis is much less than in the past but [illegible] improvement in the disease in the urinary tract has been [illegible] the author. Infection spreading from [illegible] 8 or 10 years to become evi[illegible] described were male. The con[illegible] seen were aged between 16 and [illegible] years. In about half this series no tubercle could be found elsewhere nor did the history suggest it. In the younger age groups the importance of a positive Mantoux reaction should be stressed. Borthwick observed [illegible] patients but it was not possible to follow-up all of [illegible] rarely developed fresh lesions [illegible] and in old age, and most persons [illegible] the series here [illegible] tion was the most commo[illegible] In 209 patients there were [illegible] investigation when albuminu[illegible] pyuria are [illegible] illustrates the [illegible] not infrequent, in 78 of the symptom-free cases and in [illegible] urograms were normal. Frequency [illegible] author did not [illegible] in these cases. [illegible] being much mo[illegible] radiography are [illegible] collection of ca[illegible] associated renal [illegible] by modern [illegible] when [illegible] to cure many cases without any [illegible] nephrectomy

has in the past been thought unavoidable it may now be possible to localize the lesion and to remove only part of the kidney If both sides are affected the worse kidney is removed and the other is treated by drugs. In treating epididymitis with drugs the first results, after streptomycin and sometimes with PAS, were poor; but when isoniazid was used as well a most striking improvement occurred.

Megaloureter

Examination, pathology and treatment

has been nsisted of trograms, voiding urethrograms, and cystography with ureteral peristaltic studies The results

In 15 cases ureteral peristalsis was defective or absent, and examination revealed no mechanical obstruction at the ureterovesical junctions, the bladder neck or the urethra The functional defect causing enlargement of the renal pelvis and the resulting stasis,

Investigation and management

Injuries of lower ureter

Treatment

The treatment of injuries of the lower ureter is discussed by SPRING (1956). This is most often due to unintentional injury in some gynaecological procedure and may cause obstruction, extravasation of urine or ureteral fistula. It is often helpful to pass a ureteric catheter before any operation in the pelvis, yet this precaution is often forgotten by gynaecologists, although such a procedure is often helpful as a guide to anatomical relationships and does, in itself, tend to lessen any injury to the ureters which may occur. It was not intended to deal with urinary extravasation in this paper but the principles of its treatment involve incision and drainage of the flooded tissues as well as treatment of the cause. A diagram to illustrate the principles of treatment when one ureter is found to have been tied is included, the discovery being some hours or days after the occurrence. Restoration of ureteric continuity is the aim of treatment. But if no treatment is planned then the obstructed kidney may atrophy silently, but not uncommonly it becomes infected so that direct intervention is needed. Necrosis and extravasation also occur, the latter being rarely extraperitoneal and nearly always leading to fistula formation to the vagina, the skin or the peritoneum, the first being most common. Azotaemia will develop if the other kidney is unhealthy. There are two choices of treatment, the first, deligation and the second, urinary diversion. It is usually thought that three weeks interruption of normal flow will destroy the usefulness of a normal kidney and in attempting deligation the viability of the tissue is a factor determining what can be done. If it is in doubt then the ligature is removed and a splinting ureteric catheter is introduced, one end resting in the bladder. If the ligated portion is of doubtful viability then reimplantation of the upper part into the bladder is performed. If urinary diversion is carried out then a catheter should be passed at intervals, while the ligature is softening, until normal flow returns. With fistula formation it may be necessary to wait some months before intervention as spontaneous cure is not rare. With bilateral injuries greater urgency obtains if life is to be saved and more complex procedures are needed

Ureterocolostomy

Late complications

Prevention by methods of faecal exclusion.—IRVINE, ALLAN and WEBSTER (1956) discuss prevention of the late complications of ureterocolostomy by methods of faecal exclusion. The high incidence of hyperchloraemic acidosis in this procedure has only recently been recognized. Although many observers believe hyperchloraemia to result mainly from absorption of the urinary contents by the colonic mucosa, Jacobs and Stirling in 1952 considered the renal factor more important, finding a higher incidence of imbalance in patients with poor renal function. Since modern implantation techniques have failed to reduce these complications, methods of faecal exclusion have been revised. The resulting absence of chemical imbalance is convincing, but renal infection within 6 months in 30 per cent of cases is less so. Experimental assessment in dogs of 2 exclusion methods was undertaken. Results showed that the dogs with implantation into the colon in continuity (Group I) lost weight and their condition deteriorated, 2 requiring intravenous fluids for severe acidosis. The dogs with rectosigmoid (Group II) or ileal (Group III) bladders maintained their weight and general condition. All 14 dogs in Group I developed hyperchloraemic acidosis in 6 weeks. In the 13 dogs in Group II, the blood chloride and carbon dioxide combining power generally remained within normal limits with occasional temporary imbalance. In Group III, the plasma chloride, carbon dioxide combining power and blood urea nitrogen remained normal. On section, the kidneys frequently showed thickening of the pelvis particularly in Group I; the cortex was usually normal. The ureters were not grossly dilated, nor were the mouths stenosed. Analysis of the histological findings showed the incidence of normal kidneys to be higher in Groups II and III. Pronounced pyelonephritis was significantly less in the dogs with exclusion procedures, and after 9 months being almost limited to Group I. Ureteral reflux studies suggest that good valvular mechanism in transplantation is not achieved when the

faecal stream is not excluded The biochemical results demonstrate the superiority of exclusion methods over implantation into the intact colon. Data confirm that absorption of ions across the colon mucosa is the most important factor in hyperchloraemic acidosis; no evidence of a renal damage factor was found nor was any reduction in the renal

Uretero-intestinal anastomosis

Historical landmarks

WEYRAUCH (1955) discusses landmarks in the development of uretero-intestinal anastomosis. In 1851 Simon performed the first operation to divert urine into the large bowel, the precursor of countless anastomosis techniques. Early anastomoses were complicated by peritonitis resulting from the leakage of urine at the anastomotic site, obstruction of the upper urinary tract from oedema and stricture of the ureter, and renal infection.

was largely

ius avoiding

submucosal

ter to bowel

was largely

controlled by the advance in antibacterial therapy, while the reduction of obstruction and infection, due to elimination of the intraluminal segment of ureter, was a significant surgical contribution. The next advance was the combination by Leadbetter in 1950 of the mucosa-to-mucosa technique with the submucosal method of Coffey, a procedure minimizing the risks of peritonitis, ascending infection, obstruction and reflux However, without perfect surgical technique, in making the submucosal tunnel ureteritis, stricture and obstruction may occur. These can be eliminated by temporary ureteral catheter drainage, which facilitates the precise formation of the tunnel and assists primary healing by diverting the urine from the anastomotic site. Neomycin by the mouth or, if necessary, by stomach tube is advocated The steps in the anastomosis performed by the author are isolation of the ureter, introduction of rectal tubes, selection of the anastomotic site, preparation and closure of the intestinal channel, and bringing the anastomosis outside the peritoneum. The technique is described. Following uretero-intestinal anastomosis, certain urinary constituents are reabsorbed selectively; others are not. Since predominantly acid salts are excreted in the urine and are readily absorbed, acidosis tends to develop The unimpaired kidney combats this development, but if renal function is impaired acidosis results. This has led to a renaissance of operations to exclude portions of the intestine. The diversion of urine to an excluded pouch forestalls the development of reabsorptive acidosis by limiting the expanse of mucosa exposed to urine, and lessens the

perfect functional result It therefore rests with the surgeon to employ the procedure he prefers

Lumbar urinary fistula

Surgical treatment

Case report.—DE FREITAS and SANT (1956)

aged 54 years, with a fistula

from the right ureter after a

lack of function of the left k

enlarged and prostatectomy

to catheterize the right ureter a two-stage operation was performed. Coffey's technique was employed. Two-thirds of the right ureter was replaced by an isolated segment of the terminal portion of the ileum and the distal end of the segment was anastomosed to the

bladder. Owing to leakage of urine from the anastomosis another operation was found to be necessary. The site of the leakage was repaired and the patient made a satisfactory recovery. After the operations the blood urea showed a reduction from 97·24 to 80 milligrams per cent, but urography revealed persistence of dilatation of the urinary tract and slow elimination of urine. On the other hand, reabsorption of urinary products within the segment had not affected the electrolytic equilibrium. The authors refer to animal experiments performed by McLean and Fais. A segment was taken from the caecum and intestinal continuity was re-established. After closure of the proximal end of the segment an anastomosis was effected between the bladder and the distal end of the segment. Despite these manoeuvres the urine remained free from infection and there was no alteration in the electrolytic equilibrium.

Urinary vaginal fistula

Management

COUNSELLER and HAIGLER, JNR. (1956) discuss the management of urinary vaginal fistula in 253 cases. The former method of longitudinal repair, or repair by purse-string suture, has given place to transverse repair or that in the direction of the injury. The approach, however, either vaginal or abdominal, must be determined by the site of the fistula, the number of previous attempts at repair, the amount of fixation of the vaginal wall and the possible involvement of the bowel. The cause of fistula to-day is surgical or traumatic rather than obstetric. Urinary vaginal fistulas occur most frequently between the ages of 39 and 50 years. Surgical urinary fistulas now constitute 92·3 per cent of all urinary fistulas and are largely attributable to total hysterectomy. The responsible factors are: lack of adequate exposure, haemorrhage and the excessive use of haemostats; and closure of the vagina by forceps. Fistulas following cystocele repair are almost equally numerous and are due to haemorrhage, incomplete dissection of the bladder and, above all, a suture which penetrates the bladder mucosa. A new and important type of vesicovaginal fistula and one that is difficult to repair follows transurethral resection of the bladder neck for obstruction. Fistulas resulting from radiation therapy for cervical carcinoma present serious problems. Repair in these should not be attempted for at least 3 years, when non-recurrence can be presumed. If a rectova[illegible] exists, the condition is probably inoperable. Associ[illegible] additional surgical procedures in 67 patients, the m[illegible] ureter into the bladder and nephrectomy. In this s[illegible] ienced repairs. Each repair produces more scar t[illegible] blood supply, making excision of this tissue essential and the incidence of failure to close the fistula greater with every attempt. An interval of 3 months between the primary operation, or the last repair and the current one is necessary. "Direct" and "indirect" repair procedures are employed; direct repairs being vaginal, abdominal or transvesical; the indirect repair involves urinary diversion of some description. In direct repair the vaginal approach is advised, in indirect, the approach must depend upon circumstances. In 29 such cases, all were cured in the sense that they were no longer leaking urine. Complications occur, however, regardless of the procedure but are definitely fewer by the vaginal approach. The mortality rate in any event is small.

Treatment

MOIR (1956) describes his experiences in the treatment of vesicovaginal fistula, a rare injury to-day and of gynaecological rather than obstetrical origin. The increasing use of radical hysterectomy, vaginal plastic operations and radiotherapy ma[illegible] injuries of the urethra, bladder and ureters [illegible] highly selected, because of their [illegible] closure. Of these cases 94 [illegible] from colporrhaphy. Prelir[illegible] always a possibility, and [illegible] [illegible] and grossly dilated. A

often made the excuse for transplanting the ureters, a much more dangerous procedure than is generally realized and one to be avoided The size of the fistula is no contra-indication to closure. Complete destruction of the urethra is not an insuperable obstacle, and previous operations, although making successful closure more difficult, do not make it impossible. The duration of the fistula is irrelevant to its curability Far more important factors are extensive destruction of the bladder-neck muscle or fibrotic fixation of the fistula to the ramus pubi, either of these conditions, if extreme, sometimes making complete functional cure impossible. In the 136 cases presented, closure of the fistula was achieved in all but 2, these were due to radium damage Functional cure was generally excellent, apart from 4 cases of residual stress incontinence where transplantation of the ureters was necessitated, a striking contrast to the 90 per cent "necessary" transplantations mentioned by a recent writer. The choice of operative approach depends much upon the surgeon The author strongly advocates the vaginal route, always practicable, which gives as good an exposure as the transvesical and permits a wide raw surface of vaginal wall for suturing. The operative technique is described in detail and may be termed the "Marion Sims operation in modern guise". Urethral reconstruction, additionally performed in many cases, is also described Other existing procedures include colpocleisis, combined bladder and rectal fistula repair, the Ingelman-Sundberg, the Martius, the transvesical and transabdominal and the Bastiaanse operations.

Cancer of the bladder

Prognosis and treatment

MARSHALL and WHITMORE (1956) state that survival for 5 years after the first symptom, occurred in only 4 per cent of 59 untreated patients suffering from carcinoma of the urinary bladder. An obviously poor prognosis at the time of the first examination was the chief reason for omitting treatment Estimation of symptomatic relief proved to be more difficult to evaluate than the determination of survivals Having regard to their findings, the authors recommend that papilloma of the bladder should be treated by local excision and fulguration The suprapubic approach is rarely necessary Transurethral excision provides an adequate amount of tissue for determining the grade and stage of the disease. Further observation with cystoscopic examination must be maintained, for many patients are likely to suffer from recurrence Moreover, if the tumour reappears it is likely that histological examination will reveal carcinoma in 15–20 per cent of cases. The first cystoscopy should take place 2 months after completion of the initial treatment Cystoscopy is repeated every 4 months for 5 years and then once yearly for an indefinite period. A similar procedure is recommended in cases of low grade [illegible]

[illegible] tissue after the initial employment of conservative treatment Resection of the regional lymphatic nodes should be included in the technique of the radical operation. Cancerous [illegible]

[illegible] bladder With regard to prognosis, the intrinsic nature of the neoplasm is of more importance than any delay occasioned by earlier therapeutic failures Of less importance, too, is the age of the patient provided the age is less than 75 years.

Review of prognosis in untreated cases

PROUT and MARSHALL (1956) review the prognosis in 159 untreated cases of carcinoma of the bladder. The series included 59 patients who attended the New York Hospital and the Memorial Hospital, New York. Most patients suffered from high-grade growths which

bladder. Owing to leakage of urine from the anastomosis another operation was found to be necessary. The site of the leakage was repaired and the patient made a satisfactory recovery. After the operations the blood urea showed a reduction from 97·24 to 80 milligrams per cent, but urography revealed persistence of dilatation of the urinary tract and slow elimination of urine. On the other hand, reabsorption of urinary products within the segment had not affected the electrolytic equilibrium. The authors refer to animal experiments performed by McLean and Fais. A segment was taken from the caecum and intestinal continuity was re-established. After closure of the proximal end of the segment an anastomosis was effected between the bladder and the distal end of the segment. Despite these manoeuvres the urine remained free from infection and there was no alteration in the electrolytic equilibrium

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ienced repairs. Each repair produces more scar tissue and less blood supply, making excision of this tissue essential and the incidence of failure to close the fistula greater with every attempt An interval of 3 months between the primary operation, or the last repair and the current one is necessary "Direct" and "indirect" repair procedures are employed, direct repairs being vaginal, abdominal or transvesical; the indirect repair involves urinary diversion of some description. In direct repair the vaginal approach is

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second group includes cases with bladder-neck destruction, usually of obstetrical origin, with leakage of urine and sloughing of tissue. A third group comprises urethral destruction generally following colporrhaphy and with damage to the sphincter region of the

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cystoscopy should take place 2 months after completion of the initial treatment. Cystoscopy is repeated every 4 months for 5 years and then once yearly for an indefinite period A similar procedure is recommended in cases of low-grade carcinoma in the early stages. For carcinoma, however, the Papanicolaou smear-technique constitutes a useful adjunct. Radical cystectomy is performed even in cases of low-grade, low-stage tumours if there is generalized disease of the bladder, if the tumours develop rapidly or if multiple recurrences ensue after the initial employment of conservative treatment. Resection of the regional lymphatic nodes should be included in the technique of the radical operation Cancerous invasion of the prostate is also an indication for radical surgery. The operation is preferred to simple total cystectomy. The technique of following the pelvic wall is more likely to encompass the primary growth than the technique of following the general outline of the bladder With regard to prognosis, the intrinsic nature of the neoplasm is of more importance than any delay occasioned by earlier therapeutic failures Of less importance, too, is the age of the patient provided the age is less than 75 years

Review of prognosis in untreated cases

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had reached an advanced stage by the time the diagnosis was established. Usually treatment had been withheld because the severity of the clinical manifestations indicated a poor prognosis. Dating from the first symptom the average period of survival was found to be 16½ months. Approximate figures for survival for 1 year, 2 years and 5 years were 42, 16 and 5 per cent, respectively. A woman, aged 51 years, suffered from gross haematuria but survived for 10 years. Examination revealed a stony-hard mass extending beyond the limits of the bladder. The left lateral wall of the bladder was occupied by a flat ulcerated tumour and there was a papillomatous growth on the opposite wall. Biopsy showed evidence of carcinoma. In this case there appeared to be some doubt as to whether a second neoplasm had developed or whether the original tumour had become more active. Another patient, a man aged 51 years, died of uraemia and sepsis 10 years after the onset of haematuria. In this case, however, necropsy revealed a benign papilloma. Although [illegible]sm. The data showed that female [illegible] patients committed suicide before [illegible] by means of surgical treatment. In many cases death was precipitated by obstruction and infection of the upper part of [illegible]eased by effecting [illegible] at some form of [illegible]

Study of survival rates

A study of survival rates in 2,678 patients with initial carcinoma of the bladder is [illegible]

[illegible] tumours arose in the trigone, 51 per cent involved it either alone or with other areas; of all tumours involving it, 55 per cent were infiltrating. Regarding survival data, the cases were divided into 2,023 determinate and 655 indeterminate. The former included [illegible] of tumour at t[illegible] included 167 [illegible] who had rec[illegible] entire group were, therefore, 28 per cent and 72 per cent respectively. [illegible] non-infiltrating tumour, the 5-year "tumour-free" rate was 42 per cent; for those with infiltrating tumour, 18 per cent. The 10-year rates were 27 per cent and 11 per cent respective[illegible] respectively. In the age group 60 to 69 [illegible] than [illegible] for men.

Simple total cystectomy

[illegible] in the [illegible] bladder. [illegible] The ages [illegible] nptoms [illegible] ssection before the operation was 2 years. With regard to [illegible]

followed the outlines of the bladder, but the immediately adjacent perivesical fat and small sections of the peritoneum were usually removed in addition to the prostate or a portion of the vagina. Wide removal of the perivesical tissues and systematic lymphadenectomy were not employed. Non-fatal post-operative complications included cardiac failure (3 cases), pyelonephritis (3 cases), wound infection (18 cases) and extravasation with fistula (11 cases). The post-operative mortality was 10 9 per cent. Thirty-three patients survived for 5 years after the operation and 59 patients survived for 5 years after their

was performed in 7 cases, and among this group only 2 patients survived longer than 1 year. Although patients with superficial carcinoma survived fairly well it is worthy of note that patients with high-grade growths did not live so long as patients with low-grade growths. Evidently both the grade and the stage of the disease were of importance in assessing the prognosis.

Total cystectomy

Riches (1955) considered the place of total cystectomy in the treatment of bladder growths, giving the results in 100 cases. The first attempt at urinary diversion was a ureterorectal anastomosis by Simon in 1851. Recently, antibiotics have been used to sterilize the bowel contents, but elimination of ascending infection has been nullified in some cases by electrolyte imbalance leading to hyperchloraemic acidosis It is preventable, however, by avoiding the ureterosigmoid anastomosis, instituting a low-salt diet and giving alkalis if necessary. In this series, hyperchloraemic acidosis was the primary cause of death in only 5 cases The current methods of urinary diversion are ureterosigmoidostomy, cutaneous ureterostomy and uretero-ileostomy The last two are free from the complications of hyperchloraemic acidosis, but cutaneous ureterostomy may result in a double urinary fistula Bladder carcinoma varies from a relatively benign papilloma to a deeply infiltrating solid epithelioma. Prognostically, the depth of penetration is the most important single factor Tumours in this series, therefore, have been grouped as follows: Group A, those with no muscle infiltration: Group B, partial infiltration: Group C, extension beyond the bladder [illegible]

tomy was carried out with cystectomy The average age was 58 5 years, the youngest patients having the worst prognoses. In those patients aged under 45 years, 1 in Group A survived nearly 4 years; and 6 of 7 died early from recurrence. In Group C, 4 died within a year [illegible]
well [illegible]
tion,
the rate being highest in Groups C and B Freedom from recurrence can be anticipated only in Group A. In Group B, the 5-year survival rate was only 12 per cent, any degree of muscle invasion tending to recurrence in the second post-operative year. In Group C, cystectomy can only be palliative; it should, however, be carried out if possible, even in

Millin and Masina in 1949, details of which are given.

Indications and prognosis for radical total cystectomy

Marshall and Whitmore (1956) believe that, in certain circumstances, radical total cystectomy is the operation of choice in the management of malignant growths of the

urinary bladder. These circumstances are as follows. Adequate facilities for treatment must be available. There must be clear histological evidence of the presence of carcinoma which has extended through the muscle layer, but there must be no evidence of metastases. Part of the neoplasm should be situated in the basal or rectal half of the bladder. The patient, if he were not suffering from cancer should have a life expectancy of at least 4 years. In radical cystectomy the bladder is removed with the adjacent pelvic fascia, fat and peritoneum. The satellite lymphatic nodes are also removed as far as the bifurcation of the common iliac arteries, and beyond this point if necessary. Survival for 4 years after the first manifestation of carcinoma of the bladder was recorded in 41 of 100 patients. In 53 cases belonging to the series the operation constituted a pelvic exenteration. Nineteen patients were alive 4 years after the operation. On the other hand, survival for 4 years after the first symptom of the disease was recorded in only about 4 per cent of cases in which no treatment was employed for cancer of high grade and stage. The radical operation was considered to be superior to simple total cystectomy when there were no metastases and the growth had extended beyond the muscle layer but not into the adjacent organs.

Radical cystectomy and pelvic exenteration

WHITMORE and MARSHALL (1956) report on the use of radical cystectomy and pelvic exenteration in the treatment of 100 patients suffering from carcinoma of the urinary bladder. Support for a therapeutic trial with radical surgery was afforded by the findings of Jewett and Strong concerning the relation between the depth of infiltration of the bladder wall and the incidence of metastases and local extension. There were 78 men and 22 women in the series and the average ages of the patients were 60·1 years and 61·2 years, respectively. The post-operative mortality was 17 per cent. Ten patients died from circulatory disorders such as cardiac failure and embolism, and 2 fatalities were attributed to haemorrhagic shock. In 8 cases which proved fatal there was no evidence of either metastasis or recurrence of carcinoma. Major complications after radical cystectomy included 3 cases of intestinal obstruction and 2 cases of leakage from the uretero-intestinal anastomosis. Among the major complications of pelvic exenteration were 3 cases of intestinal obstruction and 3 cases of faecal fistula. Wound infection was a common complication of both operations. Admittedly the operative mortality rate was high and there were many complications, but it should be borne in mind that radical surgery was usually employed even when the patient's general condition was poor and when other diseases were present. Moreover, the surgical technique was often difficult and the necessity for prolonged anaesthesia added to the hazards, especially in patients with obesity and severe cardiovascular disorders. Survival for 4 years after the first symptom was recorded in 31 per cent of cases, and this survival rate was similar to that recorded after simple total cystectomy. Evidently survival was less dependent upon the mode of treatment than upon the inherent malignancy and extent of the neoplasm. The prognosis was poor in cases of lymphatic node metastases. Thus, in 12 patients with metastases in the lymphatic nodes in the vicinity of the aorta and inferior vena cava, death occurred within 18 months of the operation despite dissection of the retroperitoneal nodes extending upwards from the renal pedicles.

Radiotherapy

LOCKWOOD and CHAPMAN (1956) discuss the treatment of bladder cancer. They have studied 103 cases treated in their radiological department and are satisfied that radiation therapy is the method of choice. The bladder cancers fall into two main groups, the papillary and the infiltrating, and each of these is still further defined according to cellular type. The papillary include the benign tumours which have become malignant, a change which cannot readily be judged by cystoscopic appearance or even, at times, by microscopic appearance. Once a diagnosis is made treatment may be by surgery, by fulguration or by radiation methods. The use of hormones for this purpose is often of doubtful value. Whatever kind of surgical procedure is chosen it is found that prognosis depends almost entirely on the extent of the growth rather than on the method used for approach. As the bladder reacts so sharply to radiation it is necessary to provide adequate drainage, by

... At the same time any infection present must be treated

... small tumour beds after fulgura-

Intravesical radiation of the bladder

... may be incurred when large doses

...

vascular plexus The epithelium atrophies and is often represented by a single layer of cells. Complete loss of bladder mucosa may ensue The resultant thin membrane is subject to chronic infection and fibrotic changes Clinical manifestations of these disorders include increased frequency of micturition, dysuria and dribbling. If hydronephrosis develops bilateral ureteric transplantation, and even total cystectomy, may be required Radioactive bromine produces epithelial damage owing to the gamma fraction of the ... latex rubber intravesical

...

greatly reduces the surface dose which is delivered to the mucosa

Transurethral prostatic resection

Expediting factors

The factors expediting transurethral prostatic resection by the Stern-McCarthy electrotome are discussed by BLEAKNEY and PACKARD (1956). These are physical and technical as well as those of judgment. Physical factors include a dark operating-room, an efficient irrigation system and the appropriate instruments. The technique employed is adequate and avascular removal of tissue, with downward resection in layers The length of tissue excised is increased by outward excursion of the loop of the electrotome, using the triangular ligament as a fulcrum, the loop is pressed into the tissue by swinging the ocular end of the instrument away from the plane of excision Excision is completed while trying to visualize the loop describing an arc corresponding to the contour of the prostatic capsule. The non-coagulating cutting current is used. The resected tissue is removed from

...

fibres, prostatic tissue and true capsule, false capsule, perforation of capsule, pleated appearance of contracted capsule, and the junction of the prostate with the membranous urethera Haemorrhhage is controlled by coagulation of the vessel; haemostasis is post-

...

reach through the anterior urethra.

Cancer of the prostate

Clinical behaviour

FRANKS (1956) points out that, whereas benign nodular hyperplasia develops from tl inner gland group of the prostate, carcinoma of the prostate usually begins in the oute group of the prostatic glands. While still small the carcinomatous tumour infiltrates th prostatic capsule and attacks the surrounding lymphatic and venous plexuses. Routine puncture of the sternal marrow reveals carcinoma in at least one-third of cases of prostatic carcinoma. Metastases are almost invariably found at necropsy. Active or clinical prostatic carcinoma causes about 6·5 per cent of deaths due to tumours in men aged more than 50 years. Histological evidence of carcinoma may be found in at least 30 per cent of men belonging to this age group, including patients who have died from other diseases. Similar examples of unsuspected symptomless carcinoma may be encountered in organs such as the lung, kidney and thyroid gland. Latency is not related to size and histological differentiation. Latent prostatic carcinoma may infiltrate blood vessels and lymphatics, but gross distant metastases are rarely found. In particular, metastases are less likely to develop in patients aged more than 80 years. Some patients may survive for many years without treatment. Furthermore, the prognosis is good even when carcinoma is found after prostatectomy in patients with clinically benign enlargement of the prostate. Morphologically latent carcinoma cannot be distinguished from active carcinoma. It is possible that the former condition is associated with ageing and with hormonal changes. The author reports on a series of 200 patients with benign prostatic enlargement who were treated by subtotal prostatectomy. Histological examination showed cancer in 19 cases and in this group there were 8 fatalities due to diseases other than prostatic cancer. Eleven survivors have remained well for more than 3 years.

Early detection, diagnosis, treatment and prognosis

KIMBROUGH (1956) recommends that digital examination of the rectum should be carried out annually in all men aged more than 40 years. Surgical biopsy should be performed if the prostate is found to be nodular, hard or fixed. Radical surgery is the treatment of choice for prostatic carcinoma. Operation is indicated when the gland is freely movable, when there is no evidence of metastases, and when the life expectancy is more than 2 years. Age alone is not a contra-indication to surgical treatment provided the patient is in good physical condition. Kimbrough records that when surgery was employed 36 of 56 patients were alive and well 5 years after the operation. Four patients died of cancer, 11 patients died of other diseases and the fate of 5 patients was never ascertained. A death was recorded in a patient, aged 80 years, who succumbed to pulmonary embolism on the thirteenth post-operative day. With regard to technique, the perineal approach was employed in most cases. The prostate gland and seminal vesicles were usually removed in one piece. The anterior layer of the fascia of Denonvilliers was also removed and a watertight anastomosis was effected between the bladder neck, the urethra and the triangular ligament. The posterior layer of Denonvilliers's fascia was left intact in order to avoid rectal injury. Forty-four patients were treated by palliative measures because the disease was too far advanced to warrant the use of radical surgery. In this group 11 patients survived for 5 years and almost all the remaining patients died of cancer.

Indications for various treatments

Discussing the treatment of carcinoma of the prostate, MILNER and GARLICK (1956) state that radical surgery should be employed only when the chances of effecting a cure are excellent. As for conservative treatment, orchidectomy is performed if there is evidence of extension of the disease but no dysuria. Transurethral resection, as well as orchidectomy, should be carried out if there are urinary symptoms, if metastases develop or if the serum shows an increase in the amount of acid phosphatase. Female hormone is administered when there are signs of regrowth or extension of the disease, but bilateral orchidectomy is indicated when stilboestrol therapy gives rise to nausea. Cortef therapy may

menopausal symptoms. Later, stilboestrol, by inhibiting the anterior pituitary lobe hormone, was the first non-toxic substance given by the mouth to affect carcinoma, particularly in the relief of early local symptoms and control of metastases in the prostate. To a lesser degree it is effective in inoperable breast carcinoma. After much intensive research, the active extract of the suprarenal cortex and the constitution of the substances responsible for the pharmacological action were elucidated. These were found to be of the same structure as oestrogen. Important among the many substances isolated are corticosterone, dehydrocorticosterone, hydrocortisone and cortisone. Affecting both carbohydrate and electrolyte metabolism, they are known as glucocorticoids and mineralocorticoids Experimental work on the extract "eucortone" showed it to be present in the adrenal venous blood of both dog and monkey. It was purified and called "electrocortin" on account of its potent effect on the sodium-potassium ratio in urine. Later, in view of its aldehyde character, it was renamed "aldosterone". It is probably 30 times more active than deoxycorticosterone in maintaining patients with Addison's disease in electrolyte balance. In 1954 Conn described a series of symptoms in which excretion of aldosterone in the urine was increased. Known as "primary aldosteronism", this condition is characterized by weakness and lethargy associated with tetany, polyuria and hypertension. Low blood potassium, high or normal blood sodium and an alkalosis are demonstrated. Necropsy findings show a clear-cell nephrosis characteristic of prolonged hypokalaemia. Aldosterone is preferentially produced in the glomerulosa and cortisol by the fasciculata, while corticosterone is produced equally by both zones.

REFERENCES

Albert, A , and Rees, C. (1955) *Brit. med. J.*, 2, 1028
Amelar, R. D. (1956). *J. Urol*, 75, 728.
Annis, D. (1956) *Brit. J. Urol*, 28, 351
Atherton, L., and Atherton, L. D. (1956). *J. Urol.*, 75, 111.
Bianchi, F. (1956). *J. Urol.*, 76, 645
Bleakney, P. A , and Packard, J. P. (1956) *J. Urol*, 76, 115.
Borthwick, W M. (1956) *Tubercle, Lond.*, 37, 120
Brice, M., Marshall, V. F., Green, J. L , and Whitmore, W. F., Jnr. (1956). *Cancer, N Y.*, 9, 576
Bricker, E M (1950). *Surg. Clin. N Amer*, 30, 1511.
Bulkley, G. J. (1956). *J. Urol.*, 75, 873.
Burke, D. E (1956). *J. Urol.*, 76, 508.
Counseller, V. S., and Haigler, F. H., Jnr. (1956) *Amer. J. Obstet. Gynec.*, 72, 367.
Craig-Coates, E. (1956) *J. Urol*, 75, 865
Day, E., Ying, S. H , Schwartz, M K., Whitmore, W. F., Jnr , and Bodansky, O. (1956) *Cancer*, 9, 222.
De Freitas, R., and Sadi, A. (1956) *Urol int.*, 3, 223.
Dodds, Sir Charles (1956). *J. Urol.*, 76, 301
Finkenstaedt, J. T , and Merrill, J. P. (1956). *New Engl. J. Med*, 254, 1023.
Franks, L. M (1956) *Lancet*, 2, 1037.
Ganem, E J. (1956) *J. Urol.*, 76, 179
Gibson, T. C. (1956). *J Urol.*, 76, 708.
Goodwin, W. E., and Kaufman, J. J. (1956). *J Urol*, 76, 702.
Grabstald, H (1956). *Brit. J. Urol.*, 28, 176.
Graves, F. T. (1956). *Brit. J. Surg.*, 43, 605.
Greene, H. S. N. (1956). *Ann. N.Y. Acad. Sci.*, 59, 311.
Hamm, F. C., and Weinberg, S. R. (1956). *J. Urol.*, 75, 43.
Hanley, H. G. (1956) *Brit. J. Urol.*, 28, 402.
Heintz, R. (1956). *Germ med Mon.*, 1, 169.
Hill, J. H. (1956) *Amer. J. clin. Path.*, 26, 120.

REFERENCES

Irvine, W. T., Allan, C., and Webster, D. R. (1956). *Brit J. Surg.*, **43**, 650.
James, J. A. (1956). *J. Dis. Child*, **91**, 601.
Jewett, H J. (1956) *J. Amer. med. Ass.*, **160**, 838.
Jones, R. F. (1955) *J. Urol.*, **74**, 721.
Kamrin, B B (1956) *J. Urol.*, **76**, 142.
Khoury, E. N. (1956). *J. Urol*, **76**, 149
Kimbrough, J C. (1956) *J. Urol*, **76**, 287.

519.

20, 157.
Amer. med Ass.,

Milner, W A., and Garlick, W. B (1956). *N.Y. St J. Med.*, **56**, 100.
Moir, J C. (1956). *Amer. J. Obstec. Gynec.*, **71**, 476.
Mostofi, F. K (1956). *J. Urol*, **75**, 480
Nash, D. F. E. (1956). *Brit J. Urol*, **28**, 387.
Nesbit, R M. (1956) *J Urol*, **75**, 767.

Prien, E L, and Walker, B S. (1956) *J. Amer med. Ass.*, **160**, 355.
Prince, C L., Scardino, P L., and Wolan, C T. (1956) *J. Urol*, **75**, 209.
Prout, G. R., and Marshall, V F. (1956). *Cancer, N.Y.*, **9**, 551.
Pyrah, L. (1956) *Brit J. Urol.*, **28**, 231.
Riches, E W. (1955). *Ann. R. Coll Surg. Engl.*, **18**, 178.
Rickham, P. P (1956). *Brit J. Urol.*, **28**, 394.
Ross, J C. (1956) *Urol. int.*, **3**, 90.
Scheele, K (1922) *Beitr. klin Chir.*, **129**, 414.
Singer, L (1956) *Urol. int.*, **3**, 144.
Smith, H W (1956) *J. Urol*, **76**, 685.

Webb, E A., and Smith, B. A. (1956) *J. Urol*, **75**, 1000.

1956). *J. Urol.*,
75, 615

SURGERY OF THE EAR, NOSE AND THROAT

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THE PROGRESS OF MICROSCOPIC AURAL SURGERY

Lempert's operation

In 1938, Lempert published his paper on a one-stage operation to relieve the deafness due to otosclerosis. Previously reported operations for this purpose had not proved even reasonably successful in the hands of anyone but the originator. Lempert's operation held promise of successful performance by other otologists. It was copied by a number of surgeons and in spite of the interruption caused by World War II it is now established and is being successfully performed in many countries.

Magnification and illumination

Although this operation can be performed with unaided sight, the accurate preparation of the fenestra needs magnification and good illumination. When Lempert published his paper he was using magnifying glasses and a dental drill for cutting the fenestra This was a natural step as he used the dental drill for the approach bone surgery and had also been using the drill for his endaural mastoid operation developed a few years previously

When surgeons began to adopt Lempert's technique most of them found that the visual definition obtained by magnifying glasses was less than they desired A demand therefore arose for binocular operating microscopes with a long working distance and good illumination.

At that time there was no suitable instrument available, but early in the 1950s several surgical microscopes had been built which eased the surgeon's problems. Many otological departments in various countries thus became equipped with microscopes with excellent built-in illumination enabling surgeons to examine the middle ear in the living subject in much greater detail than had hitherto been possible

The natural sequel to this re-equipping of the operating theatres was the use of microscopes in aural operations other than fenestration surgery, and it is this extension of microscopic surgery which has provided the big advance in otology

in the last few years The use of magnification has made necessary the development of special instruments. Ophthalmic instruments have been adapted and new instruments have been devised in the last few years.

Anaesthesia

During this period techniques in anaesthesia were making possible operations of long duration without endangering or distressing the patients and without producing the venous congestion that prevented surgeons from obtaining a bloodless operating field Hypotensive anaesthetic techniques were developed, and although sometimes used in ear surgery they are only rarely necessary.

Endomeatal approach

Attempts were made to inspect the cavity of the middle ear and to treat abnormalities without opening the mastoid and without destroying the tympanic membrane. The fenestration operation had shown that the tympanic membrane could be detached from the tympanic ring in part of its circumference without damaging the membrane itself, and this knowledge was applied by Rosen and others to operations on the tympanic cavity by the endomeatal approach Rosen utilized this approach for exposure of the middle ear for section of the chorda tympani in the treatment of Ménière's disease, and for stapes mobilization in otosclerosis. The former operation has not been generally accepted, but stapes mobilization is being widely practised and modified by other surgeons

The endomeatal approach presents technical difficulties but new instruments are being devised to carry it out and if successfully performed the middle ear can be inspected and the membrane and meatal wall replaced with remarkably little discomfort or disability to the patient. After operation the membrane must be held in place by meatal plugging for about one week, and two weeks after the operation the wound may be expected to have healed and the membrane once again to be normal.

Surgical inspection of the middle ear as a diagnostic procedure with no lasting disability and only a slight temporary disability has thus become a reasonable proposition which will soon become a standard operation in otology.

Myringoplasty

The application of magnification to aural surgery has revived interest in attempts to heal large defects in the tympanic membrane left by a healed otitis media. This is done by skin grafting on a prepared bed A full-thickness skin graft is obtained from behind the ear The bed is prepared by removing the surface epithelium from the external surface of the tympanic membrane, from the promontory seen through the perforation, and from the adjacent meatal wall This can only be carried out under magnification with specially devised instruments The graft is then carefully placed over the prepared raw surfaces and packed in position

Tympanoplasty

Tympanoplasty is the name given to the operations performed for chronic otitis media, in which the disease process is carefully eradicated under magnification, the mobility of the stapes and the integrity and mobility of the ossicular chain

studied, and finally, an effort is made by skin grafting to restore the function of the ear at as high a level as possible. Certain principles, clearly ennunciated by McGuckin (1955), must be observed and followed if the best possible results are to be obtained. It must be emphasized, however, that proper eradication of disease is the essential basis on which reconstructive surgery of the ear must be based.

Surgical treatment of congenital atresia

The same techniques have been applied to the reconstructive surgery of the middle ear in cases of congenital atresia of the external auditory meatus, and the restoration of hearing in these cases has been greatly improved.

STAPES MOBILIZATION

Otosclerosis causes deafness by restricting the mobility of the footplate of the stapes in the oval window. The standard method of relieving the deafness is to perform a fenestration operation, but this has disadvantages: (1) it destroys the ossicular chain and thus reduces the optimum result obtainable to 28 decibels loss on normal hearing; (2) it creates a mobile window in the external semi-circular canal and thereby causes a variable degree of vertigo; (3) it creates a tympano-mastoid cavity which needs permanent after-care of variable degree.

Rosen (1953) offered an alternative to this operation in certain cases. He suggested an endomeatal approach with mobilization of part of the footplate of the stapes and reposition of the tympanic membrane, thereby restoring normal anatomy after operation. When successful, this operation can restore near-normal hearing to the patient with no permanent distortion of the anatomy and no permanent disability. At present, it is impossible to predict in which cases the operation will be successful and it is probable that in the best hands no more than 25 per cent of cases will be successfully operated on. However, the advantages of successful stapes mobilization are so great and the disturbance of operation so slight that it seems probable that in a few years any patient presenting with deafness diagnosed as being due to otosclerosis will be recommended to have a stapes mobilization in the first instance. This operation will confirm or disprove the diagnosis by demonstrating the presence or absence of bony ankylosis of the stapes footplate to the margins of the oval window. If confirmed, an attempt will be made to mobilize the stapes, and if the operation is successful the patient will have the hearing restored and will be left with a normal ear. If unsuccessful, the patient can undergo a fenestration some months later and accept the disadvantages of this operation in order to have a reasonable chance of obtaining considerable improvement in the level of the unaided hearing.

Indication

The operation is indicated in cases of conduction deafness diagnosed as being due to stapes fixation due to otosclerosis.

Contra-indications

Stapes mobilization should not be considered in cases where there is a very narrow external auditory meatus; where there is severe distortion of the tympanic

auditory meatus The purpose of this is to control the bleeding, whether the operation is being performed under local or general anaesthesia. A Waite's dental syringe is a useful instrument for this purpose.

The incision

An incision is made down to the bone of the external auditory meatus 6–7 millimetres external to the tympanic membrane from 10 to 5 o'clock in the right ear. The handle of the malleus points to 12 o'clock. In the left ear the incision is made from 2 to 7 o'clock.

Rosen (1955) has devised a set of instruments to carry out the stages of this operation (Fig. 35).

Exposure

The skin and periosteum are elevated inwards to the tympanic membrane. This structure is then lifted out of the sulcus of the tympanic ring so that the cuff of meatus and the membrane can be turned upwards and forwards and the posterior part of the cavity of the middle ear exposed The structures to be identified will be the chorda tympani, the long process of the incus at its articulation with the stapes and the stapedius tendon It may be necessary to remove a little of the posterior rim of the tympanic ring to expose the stapedius tendon (Fig. 36*a*) using either the special Rosen instrument or a fine gouge.

Most surgeons prefer to do these stages of the operation with a microscope or with magnifying glasses. Magnification is always needed for the next stage.

Testing the mobility of the stapes

Using suitable probes (Fig 35) the mobility of the stapes is tested by touching the long process of the incus. The tendon of the stapedius is the indicator for mobility. In the normal ear the lightest touch on the long process of the incus will cause slackening of the tendon which is easily seen. In otosclerotic fixation of the footplate of the stapes resistance will be felt before any movement of the tendon is seen. The absence of any fibrous or other adhesions between the incus or stapes and surrounding structures will be confirmed.

Mobilization of the stapes

A special probe (Fig 36*b*) is placed on the anterior aspect of the neck of the stapes (Rosen, 1955) and pressure is exerted backwards in the line of the tendon of the stapedius. Appreciable pressure is needed to mobilize the footplate; it is felt to give, sometimes with an audible crack. It is sometimes very difficult to determine whether or not the footplate has been mobilized. If the operation is performed under local anaesthesia the hearing is repeatedly tested and a sudden improvement indicates that the stapes has been mobilized. If the patient is under general anaesthesia the surgeon has to rely on his observation of sudden relaxation of the tension of the tendon of the stapedius. It must be realized that in many cases the

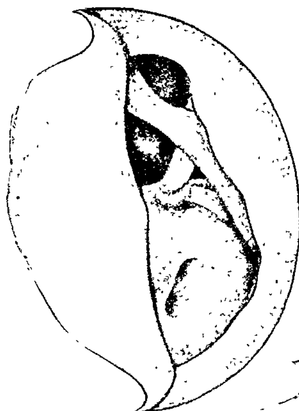


FIG. 36 (*a*) —View of middle ear obtained by reflection of the tympanic membrane with a cuff of skin of the meatal wall

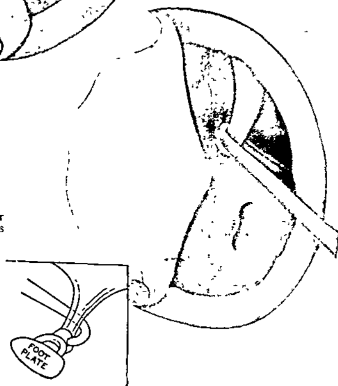


FIG 36 (*b*) —Probe for mobilization of the stapes in the correct position

stapes cannot be mobilized, and the point at which to refrain from further attempts at mobilization is decided by the judgment of the surgeon.

Closure

The tympanic membrane is replaced and packed in place with gauze impregnated with petroleum jelly.

After-treatment

The patient leaves hospital the day after operation. The packing is removed one week later. Two weeks after operation the wound can be considered healed. Any suspicion of post-operative sepsis is an indication for treatment with antibiotics, though there does not appear to be any need for their routine use.

Results

Successful cases may attain normal hearing and should reach the level of the pre-operative bone conduction hearing. Only a minority of the cases of otosclerosis will achieve a successful result. It appears probable that the successful cases are those in which only the anterior part of the footplate of the stapes is ankylosed to the margin of the oval window. Pressure, at operation, on the neck of the stapes fractures the footplate across the middle and probably fractures the anterior crus of the stapes. This leaves intact ossicular articulations communicating through the posterior crus with the posterior portion of the footplate and thus restores mobility to the ossicular chain with negligible loss of efficiency.

The duration of this hearing improvement is undetermined but Rosen (1955) reported cases where the hearing improvement had been maintained up to 2½ years and was continuing.

This is a difficult operation and one which demands a high degree of surgical skill in the use of special instruments under the difficult operating conditions of high magnification.

TYMPANOPLASTY

Chronic suppurative otitis media produces irreversible changes in the middle ear thus giving rise to permanent loss of hearing. Until comparatively recently the object of surgical treatment was to eradicate the disease, and severe loss of hearing capacity was accepted as an inevitable result of the disease. About 30 years ago surgeons began trying to limit the hearing loss, and whenever possible performed a modified instead of a classical radical mastoid operation, the objects being to preserve as much of the tympanic membrane as possible in order to avoid the persistent discharge from the eustachian tube, and to reduce the permanent hearing loss. With the introduction of the fenestration operation it was realized that the head of the malleus could be excised and the anterior attic recess exposed without causing the inevitable damage to the tympanic membrane if the long process of

the malleus is avulsed from the tympanic membrane. The variety of meatal flaps which can be fashioned from the meatal skin to line the cavity at the end of the operation was extended so that meatal skin is now seldom sacrificed and can be used whatever the site of the perforation present before operation. In this way the modified radical mastoid operation has extended its scope and split-thickness skin grafts are extensively used to accelerate epithelialization of the cavity and to shorten the period of post-operative treatment. The local use of antibiotics has also been a big factor in the latter.

The addition to these factors of the use of the operating microscope and the possibility of obtaining a bloodless field of operation has led to attempts to restore—after complete eradication of the disease process—a favourable physical state for the transmission of sound and thus the reduction of the residual conduction deafness. McGuckin (1955) enunciated several principles on which tympanoplastic operations should be based. He postulated that normal sound conduction depends on the leverage obtained by the tympanic membrane and the ossicular chain and on the sound pressure differential between the oval and round windows. If the ossicular chain is intact and mobile, hearing can be reduced by a large defect in the tympanic membrane and can be restored by repair of the defect—this is the basis of myringoplasty (Figs. 37 and 38).

If the ossicular chain is broken or fixed some restoration of hearing can be produced by surgical clearance of the disease in the attic and by grafting to establish a tympanic membrane in contact with the stapes (Fig. 39) If, however, this cannot be achieved some hearing is saved by creating a baffle over the round window and leaving the air under the baffle in contact with a functioning eustachian tube (Fig 40).

Finally, if the stapes is fixed in the oval window hearing can be preserved to some extent by creating the baffle over the round window and making a fenestra in the external semi-circular canal (Fig 41)

The technique of tympanoplasty is advancing rapidly and is developing on these principles with the use of magnification and an increasing range of delicate instruments suitable for use with the microscope The operation consists of the radical mastoid operation but modified according to the principles enunciated above and carried out with a meticulous technique made possible by use of the microscope.

SURGICAL TREATMENT OF CONGENITAL ATRESIA OF THE EXTERNAL AUDITORY MEATUS

Congenital atresia of the external auditory meatus is a relatively common abnormality and is often associated with deformity of the external ear. There is usually complete absence of the membranous and the bony canal, the meatus being represented by a dimple. Alternatively, the membranous canal may be normal and the defect in development be confined to the bony meatus. The defect may be unilateral or bilateral, it is associated with a severe degree of hardness of hearing, usually conduction deafness, but there may be associated defects in development of the internal ear giving rise to a perception deafness.

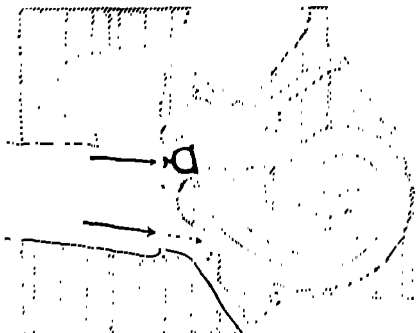


FIG. 39 —Columellar hearing Efficiency—Modified leverage plus differential.



FIG 40 —Simple baffle over round window ("petit caisse"). Efficiency—differential minus leverage

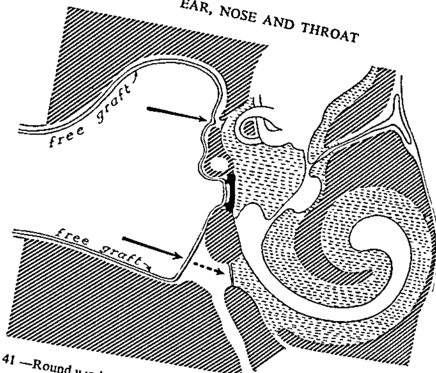


FIG 41 —Round window baffle with fenestration (where oval window is fixed). Efficiency—differential minus leverage.

Indications for operation

Bilateral cases require operation, but in unilateral cases where the other ear is normal, operation is not normally indicated. The best possible result of operation is likely to be a threshold raised by 25 decibels above normal and will leave the patient with an ear which will always need some attention and care, particularly if the patient is interested in swimming. The benefit to hearing capacity is therefore very slight in the presence of a normal ear and operation only becomes indicated in special cases. In unilateral cases the treated ear remains, after operation, the patient's deaf ear.

Radiological examination usually shows a reasonable degree of pneumatization of the mastoid air cells. The absence of pneumatization makes the operation much more difficult and it may, in fact, be impossible to find the middle-ear cavity in the solid mass of featureless bone. This is particularly so because there may be abnormal relations between the facial nerve and the labyrinth and there is considerable risk of damaging this nerve before any anatomical feature has been recognized within the temporal bone.

With reasonable pneumatization the risks of surgery are small and can be reduced to negligible proportions by extreme surgical care during the exposure. The hearing must be carefully tested and if the cochlea is normal the bone conduction will be normal. If the bone conduction is seriously depressed the result of operation is likely to be disappointing as the best level of hearing obtainable by operation is somewhat less than the bone conduction level.

The operation

A post-auricular incision is made and the outer aspect of the mastoid fully exposed. A dimple can usually be seen in the region of the suprameatal triangle. The outer aspect of the mastoid is sometimes featureless and the only definable landmark may be the temporo-mandibular joint. The likely position of the mastoid antrum is estimated and bone removed to open the antrum. If this is difficult to find, the dura of the middle cranial fossa can be exposed and followed medially until the attic of the middle ear is found When an air-containing space is found the cavity is enlarged so that the mastoid antrum, the aditus and the attic of the middle ear are exposed. The convexity of the external semi-circular canal is recognized in the floor of the aditus and working from this point the anatomy of the middle ear can be defined and damage to the facial nerve avoided. A solid mass of bone is found in the situation of the external auditory canal The long process of the malleus is deformed and fixed by bony ankylosis to this solid bone. The incus is often deformed and the head of the malleus and the body of the incus may be fixed by bony ankylosis to the walls of the attic

The bone representing the meatus must be removed. The malleus and incus are excised and the bony cavity made into a smooth radical mastoid cavity. The mobility of the stapes is tested; if it is freely mobile no further bone surgery is required If the stapes is fixed a fenestration of the external semi-circular canal should be performed either immediately or at a secondary operation when epithelialization of the cavity is complete.

Meatal plastic

A new membranous meatus is now fashioned. Incisions are made from the dimple representing the meatus and carried well into the concha It will be necessary to dissect out of the flaps and remove, some of the cartilage of the concha A meatus large enough to admit the little finger is necessary if difficulties in post-operative treatment are to be avoided.

Grafting of the cavity

Maintenance of a satisfactory cavity, short post-operative treatment and satisfactory healing are best promoted by primary skin grafting of the cavity. The middle ear is lined by a full-thickness skin graft obtained from the post-auricular skin Excision of an ellipse of skin from this area helps to pull back and open the newly constructed meatus. The skin is applied to the inner wall of the attic, is pressed against the articular surface of the stapes to produce a columella effect, is applied to the promontory and bridged over the hypotympanum and round window niche on to the floor of the newly constructed bony meatus. In this way a differential sound pressure on the two windows is established.

A split-thickness skin graft is cut from the arm or the leg for lining the rest of the cavity, which is made easier to handle if backed with fine poplin. A piece of fine poplin is prepared by smearing one side of it with petroleum jelly (Vaseline). The graft is laid with its outside on to the Vaseline surface of the poplin. The cut surface of the graft is therefore presenting externally. The graft and poplin are then cut into strips of appropriate size and the cavity lined with these strips, the

graft being laid against the bone and the poplin presenting inside the cavity. The cavity is packed with pieces of Vaseline gauze dusted with penicillin powder and the grafts are thus held in firm apposition to the walls of the cavity. The wound is sewn up. Systemic penicillin is administered for the first post-operative week.

On the tenth day the packs and then the poplin strips are removed through the meatus. The grafts are now firmly adherent to the bone and the poplin can be removed without any difficulty. The removal of the packs is a painless process and no anaesthesia is required.

After-treatment

After-treatment consists of regular aseptic toilet of the cavity. Twice a week is probably sufficient but more frequent toilet may be necessary if there is much drainage from the walls of the cavity.

Healing of the cavity

Healing of the cavity will probably be complete in about 6 weeks from the operation. The hearing can now be assessed but because the full-thickness skin graft over the middle ear does not reach its final state until 3–6 months after the operation, the final level of hearing may not be attained until this time has elapsed.

CARCINOMA OF THE LARYNX

Carcinoma of the larynx is treated by radiotherapy or by surgical excision. The selection of a particular form of treatment varies with advances in technique—radiotherapeutic and surgical.

Treatment

During the last few years the consensus of opinion has changed in favour of radiotherapy for the treatment of early carcinoma of the vocal cord, but to be successful it demands expensive and bulky apparatus, highly experienced radiotherapists and technicians, and supervision by skilled physicists. It is therefore only available in large centres to which patients have to be sent.

Successful surgical treatment is much more generally available, and although surgery may be displaced by radiotherapy at the big centres, it still has its place in the treatment of carcinoma of the vocal cord in smaller centres where radiotherapy of the highest quality is not available and moving the patient is not practicable.

Radiotherapy is gaining importance at the present time because the quality of the apparatus is improving and the results are therefore better and the side-effects less severe. The radium bomb was an advance on high-voltage therapy but was not generally available due to its enormous expense. The irradiated cobalt unit has all the advantages of the radium bomb, and because the material is cheaper this form of therapy is becoming more easily available. It is possible with this apparatus to obtain a long-term cure of carcinoma of the vocal cord in the great majority of cases. This is equally true of surgical treatment with excision of the vocal cord. The great difference, however, is that successful radiotherapy leaves

the patient with an apparently normal larynx and normal vocal cords, whereas surgery inevitably leaves some anatomical deformity and some degree of hoarseness of voice. This residual huskiness may not be very important to the patient either economically or socially but it is of great importance in that the voice is the main indicator of the health of the larynx. If the patient with a normal voice develops a recurrence he will seek medical advice. The inevitable huskiness left after surgical excision removes this safety factor and the only chance of a recurrence being diagnosed early is that it will be recognized by routine laryngeal inspection It is unfortunately hard to persuade all patients to attend for routine follow-up when they are feeling well and have no alarming symptoms.

The treatment of carcinoma of the larynx is generally successful because hoarseness, the first symptom, leads to early recognition. The persistence of hoarseness after surgery is one of the main reasons why opinion has swung in favour of radiotherapy as the treatment of choice in early cancer of the vocal cord. As long as the cure rate remains good with both forms of treatment radiotherapy will continue to be favoured until a surgical technique is developed which will lead to restoration of a normal clear voice.

POST-CRICOID CARCINOMA

Treatment

A neoplasm in the post-cricoid area has usually invaded the cricoid cartilage before it is recognized It is this fact, amongst others, which has led to the very low cure rate obtained by radiotherapy in cases of post-cricoid carcinoma. It also makes surgical cure with preservation of the larynx impossible. Surgical cure, therefore, needs total excision of the larynx complete with the segment of the hypopharynx and cervical oesophagus bearing the neoplasm In addition, radical excision of the lymph nodes in the drainage area of one side of the neck may be necessary. Removal of the larynx inevitably means a permanent tracheostomy. The excision of a segment of the pharynx means an oesophagostomy and a pharyngostomy unless primary repair of the food passage is possible

During the last few years encouraging efforts have been made to develop techniques for the primary reconstruction of the pharynx and cervical oesophagus. This is done either by using a previously raised pedicle graft from the anterior wall of the thorax, or by using a split-thickness skin graft around an indwelling polythene or latex tube The latter method is at present the more promising as it avoids the delay in removing the tumour caused in the first method by the necessity for a primary operation to raise the pedicle graft.

Shaw and Ormerod (1957) recorded a series of 17 cases treated by pharyngolaryngectomy with primary reconstruction of the hypopharynx with a split-thickness skin graft. There were some cases of stenosis of the reconstructed pharynx but the results were remarkably good and will improve as the technique develops Their experience is typical of that of other surgeons interested in this work.

The essential factors in the developing technique are as follows:

(1) The excision of the tumour-bearing area and its lymphatic drainage area must be complete.

(2) Suitably shaped indwelling pharyngeal tubes (Fig. 42) must be available.

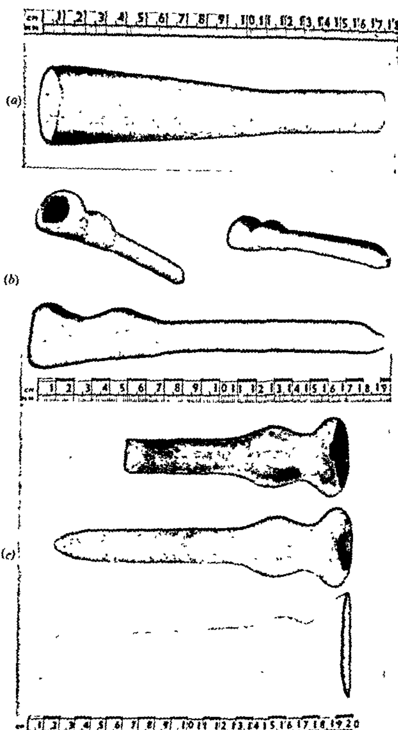
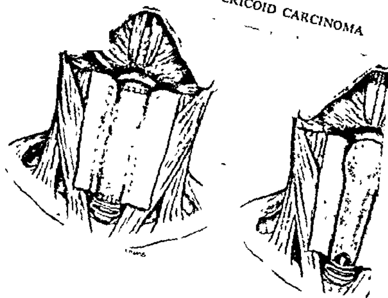


FIG 42.—(a) Polyethylene "Portex" tube, (b) self-retaining latex tube stent (size No 1); (c) original plaster cast from which the tubes were developed One finished tube intact and one trimmed for use showing anterior bevel at the lower end.



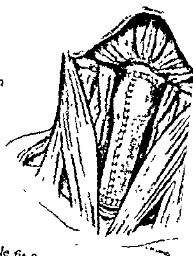


FIG 43 —Method of inserting the split skin graft and placement of the tubular stent

They must be of varying sizes so that a suitable fit for the cervical oesophag[...] be found when reconstruction begins

(3) A large-size uniform-thickness skin graft must be cut. This must be enough to sew to the pharyngeal mucosa.

(4) The fitting and suturing of the graft must be carried out with metic[...] care and accuracy (Fig. 43)

Indications

If adequate surgical facilities are available laryngo-pharyngectomy has bec[...] the treatment of choice for a post-cricoid carcinoma with the ulcer fixed to cricoid If the ulcer is freely mobile on the cricoid, as demonstrated by oesop[...] goscopy, radiotherapy offers a reasonable prospect of cure and may be [...]

the treatment of choice. This situation is rare as the ulcer is usually fixed when the diagnosis is made. In any case of carcinoma of the hypopharynx which involves the larynx this operation is a suitable method of treatment.

Contra-indications

Gross invasion of the neck by the carcinoma is a contra-indication. Unilateral lymph-node involvement is not a contra-indication because a block dissection of one side of the neck can be performed with the pharyngo-laryngectomy and the tumour and the affected tissues of the neck can be removed in one block.

The general condition of the patient may be so poor as to contra-indic[illegible] operation, but this can usually be corrected, if necessary, by a temporary ga[illegible]tomy performed as a preliminary operation

The main contra-indication to the operation is the extension of the tum[illegible] downwards into the thorax. The tumour can be demonstrated by a lateral rac[illegible]graph of the neck. It shows the larynx displaced forwards from the cervical vertebr[illegible] by the tumour and if this forward displacement of the airway extends into th[illegible] thorax the case is inoperable by present techniques because of the impossibility of repair where the upper cut end of the oesophagus is appreciably below the thoracic inlet.

ABSTRACTS RELATING TO EAR, NOSE AND THROAT CONDITIONS

The hypocellular mastoid

Elucidation of its nature

TUMARKIN (1957) investigates the nature and vicissitudes of accessory air spaces of the middle ear, the aim of the work being the elucidation of the nature of the hypocellular mastoid. Only in man is there variation, not only in the air cells of the individual, but also between his two ears With the advent of radiology, the formerly held theory of the acellular mastoid became untenable and hypocellular bone could no longer be regarded as the result of an inflammatory sclerotic transformation of a fully cellular bone Cheatle, in 1910, emphasized this fact and, drawing attention to the frequent occurrence of disease in it, concluded that it was simply a natural variant, just as "normal" as the fully pneumatized mastoid. Since then, Wittmaack has postulated the conception of inhibition and Krainz the theory of eustachian block. Diamant amplified this theory and showed that all sizes of mastoid occur between 0 and 30 centimetres*, as measured by planimetry on suitably aligned radiographs All sizes, moreover, he believed to be normal, and genetically determined, transmitted from parent to child He also admitted the existence of lesser environmental effects, laid down *in utero* and unalterable. This is a remarkable conception, since the air cell system is non-existent before birth He maintained that these intra-uterine environmental forces were entirely normal, while their nature was unknown The writer rejects all these postulates except the first, which he confirms, while putting forward an alternative neo-wittmaackian hypothesis. He argues that hypocellular mastoids are produced by inhibition or inflammatory sclerosis, or both. The major cause of inhibition is the upper respiratory infection of childhood, which can occur at any time up to approximately the age of 14 years. This process is only one facet of a complex upper respiratory syndrome and is a disease of civilization. It is commonest, and almost endemic,

among the poorer and overcrowded classes The pathological nature of hypocellularity

presence of stratified squamous epithelium: the first, or neoplastic, theory of McKenzie (1931) regards it as a congenital inclusion dermoid cyst, the second, or immigration, theory of Bezold, Habermann and others attributes it to undermining of the middle-ear mucosa by the epithelium of the external auditory meatus; the third declares that the stratified squamous epithelium is produced by metaplasia from the original monocellular lining. The author holds a modified opinion of the metaplasia theory. In his view, cholesteatoma, in common with hypocellularity and inflammatory otosclerosis, is a preventable disease, sharing a common origin in the upper respiratory disease of childhood and constituting his unifying hypothesis Theories attributing these conditions to intrinsic dyscrasia are unacceptable, since the implication is that they cannot be prevented. Far from this being the case, they are undoubtedly susceptible to adequate treatment.

Plastic surgery of sound-conducting apparatus

Review of principles

Zollner (1955) reviews the principles of plastic surgery of the sound-conducting apparatus. Since the operation is generally combined with a curative one, two factors influence the result, which can only be judged by the ultimate functioning of the sound-conducting apparatus Patients with total loss of the tympanic membrane and bare windows are termed "fensterhorer", since hearing is through the membrane of the oval and round windows only and depends upon the small difference in the impedance of these windows. The threshold usually lies between 50–60 decibels, and hearing may be

effect of vibration of the new membrane and its transmission into the oval window. Spontaneous plastic results following inflammatory lesions and radical operations suggested the artificial creation of similar conditions. First observations with the stapes in contact with the tympanic membrane indicated a columella effect, but the author later found that the presence of a stapes was immaterial, the substitution by a graft of the sound-conducting apparatus sometimes producing the 24 decibel level of hearing. The

membrane preserved The operation should leave the maximum of the original structure consistent with preventing recurrence of the disease. Although a defective chain of ossicles can rarely be restored to normal vibration, an existing or restored tympanic

Tympanoplastic operations

Prognosis and results

WULLSTEIN (1955) discusses the prognosis and results of the tympanoplastic operations. The theoretically possible results can be ascertained on the basis of the pre-operative audiological study of the middle-ear apparatus and on the types of tympanoplastic operations that have been developed from anatomical and pathological reasoning. The various operations are discussed and 5 types of tympanoplasty defined. In types I–III the tympanic membrane or a skin graft is used for sound-pressure transformation. In types IV and V the pathological destruction has been such that no sound-pressure transformer can be constructed and the graft is used as a baffle to protect the round window from the sound pressure and thus establish a sound-pressure differential between the two windows. For this to be effective there must be an air space between the membrane and the round window which must be in communication with a functioning pharyngo-tympanic tube. In types I–III the results are reasonably good and are near the theoretical level. In types IV and V the results are sometimes disappointing, but can reach the level obtained by fenestration in cases of otosclerosis. Satisfactory results are dependent on careful selection of the type of operation applicable to each case, but, as yet, the average result of all types of tympanoplastic operation does not come up to theoretical expectation. This is due partly to the problem of assessing the functional efficiency of the two windows, partly to the difficulty of establishing proper ventilation of the tympanic cavity, and especially to the quality of the new tympanum as a sound transformer and protector of the round window against the sound pressure. As a result it can be seen that, in a compromise of both these functions, even the healthy ear-drum does not always fulfil the object of protecting the round window from sound. A modified technique of the surgical approach used for fenestration permits observation of the whole of the middle-ear structures without any further damage being caused by the surgical exposure.

Otosclerosis

Technical problems in surgical treatment

SHAMBAUGH (1956) discusses technical problems in the surgical treatment of otosclerosis. In the early stages, mobilization of the stapes is possible, but later a new window must be made in the bony capsule of the labyrinth. An early problem in surgical therapy was the prevention of infection and meningitis, the perilymph within the labyrinth being directly continuous with the cerebrospinal fluid. This, however, was solved by asepsis before the advent of antibiotics, which are still no substitute for scrupulous aseptic technique. A major obstacle to successful fenestration was the tendency to osteogenic closure of the new window. Even fine particles of bone-dust are powerful osteogenic stimulants, to combat which a simple irrigating device was conceived. The labyrinthine capsule has three distinct bony layers, and by wide removal of the outermost periosteal layer, full advantage may be taken of the poor osteogenic response of the middle endochondral bone. Skin closely applied to bone inhibits osteogenesis; Sourdille therefore covered the fenestra with a thin plastic skin flap. Since the endosteal membrane lining the labyrinth limits new bone formation, it must be preserved intact, ensuring its union with the skin flap. Any factor inducing fibrosis and promoting new bone formation must be avoided. Application of these factors has reduced failure by closure to a rarity. There remains, however, the baffling problem of post-operative serous labyrinthitis, in treating which irrigation by Gey's solution is advocated.

Mobilization of the stapes

Operative technique.—MYERSON (1956) describes mobilization of the stapes for otosclerosis. In 1952, Rosen, while testing the mobility of the stapes footplate before fenestration, found that he had mobilized the stapes and restored the patient's hearing. On this basis the author has devised a simple and safe technique. Strict asepsis of the nose, nasopharynx and external auditory canal is procured before surgery. Procaine and epinephrine hydrochloride are injected into the retro-auricular fold at a junction of the cartilaginous

and osseous canals The incisions are made with two knives, one cutting forward and backward along the roof of the canal, the other from side to side, joining and terminating just inside the chondro-osseous juncture. Elevation of the flap by two elevators is continued until the point of attachment of the drum is reached. The more curved elevator is then insinuated into the sulcus to which the rim of the tympanic membrane is attached. This is carefully raised and reflected anteriorly to expose the tympanic cavity and incudo-stapedial articulation. When the long process of the incus and the head of the stapes are identified, a forked instrument is fitted over their articulation, and a revolving rod, inserted into a dental handpiece, brought into contact with the fork Vibrations are thus created and transmitted through the articulation to the fixed footplate; 9,000 revolutions per minute appear adequate These vibrations also break up any adhesions between the incus and malleus, the incus and stapes, or both. If the vibration technique fails, Rosen's manipulation of the footplate should be tried, but it must be recognized that many footplates cannot be mobilized within the safety limit and with a good hearing prognosis. If mobilization is unsuccessful, Lempert's fenestration operation must be performed at a later date if the hearing is to be improved by surgery.

Results of operation—ROSEN (1956) illustrates results of mobilization of the fixed

tones and speech audiometry. Two patients achieved normal hearing. Suitability for surgery is determined by the high level of bone conduction In class B (maximum loss of 20 decibels by bone conduction, average loss by air conduction) 39 3 per cent and 41·4 per cent respectively, reached similar levels. Five patients achieved normal hearing. Classes C and D, with greater hearing loss, produced relatively satisfactory results. In

the cochlear deafness.

Postural vertigo due to sudden partial loss of vestibular function

Aetiological considerations

LINDSAY and HEMENWAY (1956) review postural vertigo due to sudden partial loss of vestibular function. The onset is sudden and severe, without deafness or signs of central nervous system disease, and is followed by gradually decreasing vertigo except upon postural changes Seven cases are recorded in which the similarity of clinical charac-

the first 24 hours There was slight discomfort in the right ear, but no tinnitus and no deafness. Unsteadiness persisted and vertigo recurred on quick movements of the head, especially to the right. "Vascular accident in the right labyrinth" was diagnosed. Spontaneous nystagmus to the left side in all positions was present, increasing in intensity when postural tests were performed. After 13 years, death occurred from coronary

thrombosis. The degenerative changes localized in Scarpa's ganglion, and the superior division of the right vestibular nerve showed a definite relationship to the episode of vertigo, while the acute onset and the persistence of postural vertigo could be attributed to vascular thrombotic occlusion occurring at the site of the blood vessels connected with the vestibular nerve. The other cases presented similar symptoms and suggested the same aetiological interpretation, that of vascular accident, probably occlusion, affecting the vestibular system. In all but one case the side involved was indicated by the nystagmus, auditory symptoms, and reduc[illegible]
follows a well-known course with regress [illegible]
may last from several weeks to over 3 ye[illegible]
partial loss of function, as opposed to e[illegible]
vestibular system on one side [illegible]
acute proce[illegible]
due to the f[illegible]
of active impulses from part of the labyrinthine receptors with sudden impairment of other receptors appears to be characterized by postural vertigo and positional nystagmus.

Eustachian deafness

Response to nasopharyngeal irradiation

[illegible]
tic [illegible]
if [illegible]
of [illegible]
in children under the age of 6 years, and that while spontaneous recovery is the rule, [illegible]

[illegible]

tion of the epithelium through subepithelial lymphatic channels from the nasal passages or adenoids The condition is a clinical entity rarely found after the age of 7 years. When [illegible]

[illegible] used for localized [illegible] 0 roentgens to one [illegible] found successful.

Pharyngeal diverticula

Treatment

Harrison (1956) discusses the treatment of pharyngeal diverticula. The anatomy and physiology are briefly described. In the early stages muscular incoordination of the

cricopharyngeus occurs and there is some difficulty in swallowing, but the discomfort and pain are often disproportionate to the size of the diverticulum. Similarly, much dis-

and resolution is unlikely, extirpation of the sac may be performed, but since the patient is usually over the age of 50 years and emaciated, the operation is not without risk. Mosher divided the septum between oesophagus and diverticulum with scissors, and described 6 successful cases. Dohlman, performing the same operation by diathermy, stated that an external operation is unnecessary unless excision of the sac is indicated. The author advocates a similar procedure in endoscopic coagulating diathermy division of the opposing walls of the sac and the oesophagus, including the cricopharyngeus muscle. This allows the contents of the sac to escape and lessens the muscular barrier to

treated by this operation, 6 are described.

Laryngeal mechanism

Cine-radiographic studies during swallowing

ARDRAN and KEMP (1956) explain the closure and opening of the larynx while swallowing. Cine-radiographic films were taken during breathing and while swallowing barium emulsion and water respectively.

the lower pharynx, the lumen of the larynx was reduced, the edges of the cords inclined upwards and medially, their under-aspect forming a narrow arch, the cavities of the ventricles were obliterated; the cords were thickened. Closure, completed as the bolus was finally

was in the

and as it r

closure and

concluded by elevation of the lateral attachments of the vocal cords. Imperfectly understood, this elevation is often observed during speech, and is absent in some cases of

The theory that the vestibular folds constitute an outlet valve assumes that they are normally turned down as flaps, but the present radiographic studies show that, even with complete closure, the long axis of the obliterated ventricle is never raised above the horizontal.

Recurrent laryngeal nerves

Injury during thyroidectomy

RIDDELL (1956), reviewing the injury to recurrent laryngeal nerves during thyroidectomy, compares the results of identification and non-identification in 1,002 nerves exposed

to risk. Before and after every thyroidectomy, indirect laryngoscopy should be performed, particularly in patients who have had a previous operation on the gland, or if carcinoma, chronic thyroiditis or myxoedema is suspected. Some surgeons prefer to identify the nerve by dissection, while others believe such exposure to produce palsies. The greatest factor predisposing to injury is fixation of the nerve to thyroid where the nerve intermingles with the terminal branches of the inferior thyroid artery. The author considers the sites of greatest vulnerability to be on the lateral surface of the gland, where the nerve may be injured by forceps or sutures; at the lower pole, where it may be included in ligation of the veins; at the upper pole, where it may be picked up with small bleeding arterial branches. The nerve is visually sought where it comes into relation with the inferior thyroid artery and is recognized by a minute vein upon its surface. By palpation, safer but less accurate, it feels like a cord which can be gently rolled against the trachea. The injury-rate, computed by relating the number of nerves injured to the number of operations, was, in this series, 4·3 per cent. The injury rate for identified nerves (11 of 511), although not significantly less than that for unidentified (18 of 511), suggests a compromise. The surgeon should visually identify the nerves until he is familiar with their course and distribution; thereafter, he may discontinue routine identification. The early post-operative differentiation between complete and partial paralysis is not always easy, but if paralysis of the nerve persists the cord remains immobile on phonation and appears thin and withered. No purely anatomical basis explains the preferential paralysis of the abductors, but Negus suggested that the protective function of the adductors gives them greater viability than that of the more recently evolved abductors.

Carcinoma of the larynx

Surgical treatment

ORTON (1956) discusses the surgery of carcinoma of the larynx, regarding the classification of which much confusion exists. The old terms of intrinsic and extrinsic cancer convey no information as to site, prognosis and treatment. It is better, therefore, to limit the condition to true cancer of the vocal cords or to designate it by its original anatomical site. The latter presents many problems in diagnosis and treatment, since the laryngeal lesion may be so extensive that its origin is obscured. In the author's experience of 441 cases, the best results were obtained in the following order for 5-year cures: cords, 171 cases; below the glottis, 78; ventricles, 54; epiglottis, 45; epiglottis and tongue, 23; aryepiglottic fold, 25; arytenoid, 25; pyriform sinus, 20. There was recurrence in approximately 20 per cent; operative mortality was only 1·3 per cent. Treatment included irradiation, thyrotomy and partial or total laryngotomy, each with its specific indications In 76 cases, cervical metastases occurred after total laryngotomy, for which a neck dissection had been performed. Palpable lymph nodes at the time of primary operation should indicate the need for such a dissection, which may also be advisable on the side of the lesion without palpable nodes in certain other sites. Lymphatic drainage is such that early operation is essential before metastasis becomes evident. The combined operation is contra-indicated in cordal lesions; and all surgery is contra-indicated in cases of massive fixed lymph nodes.

Carcinoma of the hypopharynx

Laryngo-oesophagectomy with laryngo-tracheal autograft

SOM (1956) discusses laryngo-oesophagectomy by primary closure with laryngo-tracheal autograft. In most instances of carcinoma of the hypopharynx the cricoid and posterior wall of the pharynx are involved, while the anterior portion of the larynx is not involved, suggesting that this may generally be preserved together with the anterior circumferences of the cricoid and the upper tracheal rings after wide excision of the tumour. A case is reported in which hypopharyngoscopy revealed a stenosing lesion at the level of the cricopharyngeal muscle, which, on biopsy, proved to be a squamous-cell carcinoma. Under local anaesthesia tracheotomy was performed. Controlled respiration was maintained by thiopental and a U-shaped incision made from mastoid to mastoid, leaving a tongue of skin above the suprasternal notch, through which a tracheostoma was to be

ade. The further procedure is described in detail The tumour was finally delivered *en asse*, the specimen containing the unopened resected oesophageal segment, the contiuous posterior portion of trachea and party
ne anterior portion of the larynx and trache

introduced
ie autograft
metastatic
the side of
aximum growth is advocated. The value of the operation is judged in terms of palliation
d subsequent ability to swallow.

arcinoma of the larynx and hypopharynx

adical en bloc *operation*

ssection in one stage is performed in preference to the more dangerous two-stage
peration with resection of both internal jugular veins. In the technique presented, one
f these veins is preserved, but is so dissected that its sheath is removed in its entirety.

ne operation include dissections of the posterior cervical triangle, the internal jugular ein, the pretracheal region, and the submaxillary region These dissections are described n detail With removal of the internal jugular vein sheath, all the accompanying lymph odes are removed, constituting part of the *en bloc* specimen. After ligation of the laryneal pedicles, the other side of the neck is dissected, with the exception of the internal ugular vein. The isthmus of the thyroid is then cut and its lobes dissected, isolating hem from the trachea which is incised at the point of tracheotomy With an electrourgical knife, the suprahyoid muscles are cut to reach the lingual surface of the epiglottis The pharynx is now opened and the tumour exposed and removed The wound is closed nd drained and the operation area cleansed. The technique of the operation must of ecessity vary with the extension of the tumour. This may invade the subglottis, the hyroid, the pyriform fossa, the posterior hypopharyngeal wall, the vallecula, the base of the tongue and even the tonsillar region Post-operative treatment includes streptomycin sulphate and penicillin during the first week Frequent suction is performed through he tracheotomy Oral feeding begins on the tenth day, and x-ray therapy as soon as the wound has healed In 38 one-stage dissections, with removal of the larynx in 18 cases, here was no operative mortality

Cancer of hypopharynx or cervical oesophagus

Pharyngo-laryngectomy with graft reconstruction

SHAW and ORMEROD (1957) discuss pharyngo-laryngectomy with primary "sleeve graft" reconstruction In four years, 17 selected cases of cancer of the hypopharynx or

section is performed on the side mainly involved, whether the metastases are palpable or

not. In the case of an extensive circumferential tumour involving the whole cervical oesophagus, elective bilateral staged neck dissection is advocated Contra-indications include unfitness for, or objection to, surgery, or direct extension of the growth below the level of the first thoracic vertebra. The resection is a routine one When the tumour encircles the hypopharynx and cervical oesophagus, the resected material includes the hyoid bone, strap muscles and all connective tissue and lymph nodes in close relation to it The operation is described. Complete operative haemostasis is essential; whole blood transfusion is routine. A rectangular split-skin graft is used to create a "sleeve" type of new upper gullet. Taken in one piece measuring 6 by 4 inches, it should have a thickness of 0 025–0 035 inches; exact measurements are essential to success. The self-retaining latex rubber tube stent, and the technique of grafting are described. Post-operative treatment is basically that of total laryngectomy. Few complications arise with the employment of latex tubes. Antibiotics virtually eliminate chest complications and local wound infections. The occurrence of stenosis, which largely led to the abandonment of this operation, produced only dysphagia in approximately two-thirds of cases in this series The factors encouraging stenosis are inadequate or too thin grafts, haematoma, fistula formation, poor immobilization of the muco-cutaneous junction, the last factor only, possibly being uncontrollable and necessitating periodic dilatation Recurrence of disease was seldom encountered in the reconstructed gullet or on the side where a combined neck dissection was performed, but rather in the superior mediastinum, low in the neck or in distant metastases. In this series, the proportion of women to men was 13 to 4 Of the 17 patients, 6 who had already undergone primary irradiation succumbed to inoperable recurrence within 3 years. Of the 11 treated initially by radical surgery, 7 were alive and well up to 4½ years. Although this single-stage technique reduces the morbidity of treatment, the prognosis remains extremely serious. The greater use of radical resection, however, may eventually lead to improved survival

Chronic otitis media

Restoration of function of middle ear

WULLSTEIN (1956) has written on the methods of restoring the function of the middle ear in chronic otitis media Ideally one should strive to restore a ventilated middle ear which is in a healthy state and at the same time construct a new system of sound conduction to the cochlea This involves the choice of various procedures depending on the extent and type of damage which has occurred. No rigid procedure, as in the fenestration operation, is likely to suit many cases. Finally the tympanum must be restored by grafting or by substitution of another tissue. Marginal perforation, cholesteatoma or a purulent secretion are no bar to this being done, especially as the newer remedies permit better control of infection. If a useful functional result with retention of the oval window is difficult, it may be desirable to make a new window in the lateral semi-circular canal and in the scala tympani through the round window niche and membrane. By using audiograms the location and degree of abnormality may be more accurately determined and to make use of this diagnostic aid an artificial tympanic membrane must be provided It may be found, by repeated testing, that at one time at least there is a marked increase in the audiogram. If this is found then clearly both windows of the labyrinth are functioning properly. Strong magnification is necessary to enable the surgeon to understand what structural changes have occurred If the tympanic membrane is entirely lost a good view is possible, but if there is only partial loss care is needed to prevent widening of the hole and loosening of the membrane from the annulus osseus. The author observes the antrum through a drill hole behind the bridge, controls the upper part of the middle ear by removing Shrapnell's membrane and drilling through a small marginal part of the bridge so that the epitympanum comes into view. The lower middle ear is also viewed. If the mucous membrane of the middle ear is much thickened and infected and if the window niches are full of granulations it may be difficult to restore the mucosa to normal before operation and thus a tympanoplasty will be more difficult. It may be necessary to carry it out in two stages, though a one-stage operation is preferable If two stages are needed then a radical operation with removal of the bridge will be necessary. All hypotympanic cells should be opened up so that no pyoceles remain; a resorbable antibiotic packing is

used to fill out the middle ear. Free skin transplants have been used by Wullstein to cover defects in the tympanic membrane, these being taken from behind the ear which has no hairs and few elastic fibres The scar here is invisible. As this area is used for the grafts it is also convenient for an approach to a point where the round window niche can be inspected. This is in the anterosuperior portion of the niche and can only be seen from behind and below. Under the microscope one may perceive, after gently touching the stapes, the more evident vibrations of the round membrane. The first bandages are removed after a week. The writer states that recurrent perforations are seen in less than a tenth of the cases treated

REFERENCES

Adams, W Stirk (1956) *J. Laryng.*, 70, 512
Ardran, G. M., and Kemp, F. H. (1956) *Brit. J. Radiol*, 29, 205.
Barbara, J. E. (1956) *Arch. Otolaryng., Chicago*, 63, 372

Rosen, S (1953) *N.Y. St J Med.*, 53, 2650.
— (1955) *J Laryng*, 69, 297.
— (1956) *J Amer. med. Ass*, 161, 595
Shambaugh, G. E. (1952) *Ann. Otol., etc. (St Louis)*, 61, 873

HEART, PERICARDIUM AND GREAT BLOOD VESSELS

HEART SURGERY

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The survey of cardiac surgery which appeared in *Surgical Progress* (Hill, 1952) dealt mainly with the problems of Fallot's tetralogy, mitral stenosis and pure pulmonary valvular stenosis The last paragraph in this article read as follows: "Though some progress is to be expected it is unlikely that there will be major advance in this field before the use of independent circulation is made practical in man."

This prognostication has been substantiated by developments during the past 5 years The most notable advance has been the development of techniques designed to allow the surgeon to operate within the heart under direct vision. It is obvious that if the circulation of blood through the chambers of the heart is halted, some method must be devised either to protect the body, and particularly the cerebrospinal system, from anoxia, or the circulation must be continued by a machine which imitates the functions of heart and lungs.

Reduction of body temperature, or hypothermia, serves the first purpose, while machines designed to establish an extracorporeal circulation during cardiac by-pass have been developed to such an extent that their place in cardiac surgery is now established

HYPOTHERMIA

At normal body temperature circulatory arrest for over 4 minutes with consequent anoxia usually produces permanent cerebral damage. Bigelow, Lindsay and Greenwood (1950) demonstrated that if the temperature of a dog is lowered from 38–20° C., metabolism and oxygen requirement drops to 18 per cent of the normal value. At this temperature they succeeded in excluding the hearts of dogs from the circulation by clamping the venae cavae and azygos vein for periods of 15 minutes with survival In some experiments token cardiotomy was carried out.

From that beginning much work has been done to ascertain a safe level of hypothermia in man, the metabolic changes which occur when the circulation is arrested, and how cardiac irregularity, particularly ventricular fibrillation, may be prevented or reversed

Bailey and his colleagues (1954) reported a case of complete artificial circulatory

arrest at 21·6° C. for 22 minutes during an operation on an infant with transposition of the great vessels. There was no evidence of cerebral damage 13 hours after operation, but the limit is probably about 10 minutes at 28° C. with hope of survival without cerebral disturbance

Swan and Blount (1956) in an analysis of 111 cardiac operations performed with hypothermia considered the time limit to be at the most 8 minutes and preferably 6 minutes at temperatures between 29° and 32° C. At temperatures below 28° C. the risk of ventricular fibrillation is high and efforts to re-establish normal rhythm are frequently unsuccessful The use of this technique is therefore limited to procedures which can be quickly accomplished.

At the present time hypothermia is clearly indicated for open atriotomy and closure of uncomplicated atrial septal defects of the secundum type and for the relief of isolated pulmonary valvular stenosis via the pulmonary artery. It has been used with success for pulmonary infundibular resection, open aortic valve surgery and for the removal of intra-atrial tumours. It is contra-indicated in such conditions as atrial septal defects of the primum type and ventricular septal defects, because there is not enough time to carry out the complicated repair usually required Moreover, surgery on the ventricles at low temperatures is prone to lead to irreversible ventricular fibrillation An account of hypothermic anaesthesia is given by Scurr and Organe (1956) with a description of various aspects of body cooling

In the case of children a low temperature is quickly achieved by wrapping the child in a blanket containing a closely coiled plastic tube through which is passed iced brine. Rapid cooling in adults can be produced by total immersion, while anaesthetized, in a bath of cold water Delorme (1952) was the first to describe pervascular cooling in which blood from a cannulated artery is cooled and returned to the venous circulation This method, however, may result in permanent damage to an important artery, and also introduces the burden of an arteriovenous fistula. Ross (1954) has modified this procedure in using veno-venous cooling. Blood from a catheter placed in the right atrium is withdrawn by means of a hand-driven rotary pump and passed through a plastic coil surrounded by a refrigerant solution, it is then returned to the body via a catheter placed in the saphenous vein with its tip in the inferior vena cava. The advantage of this extracorporeal method of cooling is that a decision can be made as to whether hypothermia is desirable after the chest is open This advantage is offset by its complexity compared with the more simple methods of surface cooling

THE EXTRACORPOREAL CIRCULATION

The possibility of temporary by-pass of the heart to facilitate visual intracardiac surgery has stimulated world-wide interest and investigation during the past 20 years To achieve this objective it is necessary to continue the function of the lungs as well as the heart by mechanical means—removing the blood as it returns to the right atrium and returning it to the aorta after the passage through an oxygenator (Fig 44) Provided that the aortic valve is competent there is no regurgitation of blood into the left ventricle, although the coronary arteries are perfused by blood and the heart beats normally

Pioneers in this work (Bjork, Gibbon, Jongbloed, *Dennis*, *Melrose*, *Dodrill* and Mustard) devised ingenious but complicated machines designed to imitate basal cardiopulmonary function. The advent of hypopthermia suggested that the same objective might be achieved by this more simple technique. For this reason interest in the extracorporeal circulation slackened for a while but was renewed when the limitations of hypothermia were exposed.

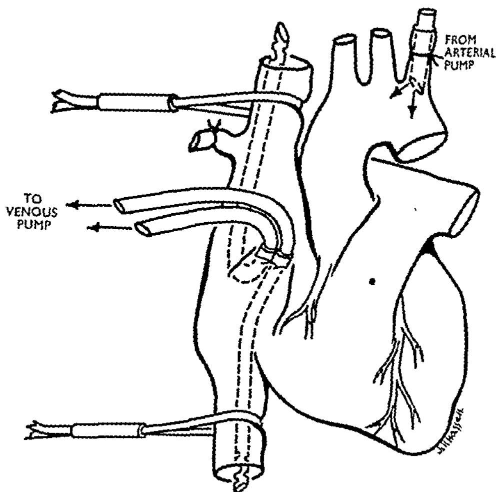


FIG. 44.—Cannulation of great vessels for cardiac by-pass.

For a long time it was accepted that any artificial heart should be capable of matching cardiac output and consequently an extremely efficient oxygenator was required to deal with the very large volumes of blood involved. Even when these criteria are fulfilled, however, it is very difficult to obtain the expected venous return once the subject is connected to the heart-lung machine. The reasons for this phenomenon are not yet fully explained. Of the machines designed to accept venous return of almost any magnitude the best known and clinically the most successful is that elaborated by Gibbon and his colleagues (1954) and a series of

associates after many years' research, and it was he who in March of the previous year performed the first successful intracardiac operation using the extracorporeal circulation with repair of an atrial septal defect. Kirklin and his colleagues (1955) at the Mayo Clinic made slight modifications to this apparatus and used it to perform operations for ventricular septal defects.

The Gibbon heart-lung machine

The Gibbon machine is a reliable but complicated apparatus, difficult and expensive to copy, although quite recently a simple version has been made available commercially.

A basic feature is automatic maintenance of constant blood volume in the apparatus by means of photo-electric levelling devices. Flow of blood from the venae cavae is initiated and maintained by a controlled vacuum within the venous reservoir of the machine Blood from the open heart, mainly from the coronary sinus, is removed by gentle suction and with blood from the venous reservoir is collected in a main reservoir Blood then flows to the upper part of the oxygenator, which consists of a series of vertically placed stainless steel mesh screens down which blood flows as a thin film exposed to an atmosphere of oxygen Gaseous exchange takes place and oxygenated blood then passes through an arterial pump via a filter to a cannula tied into the proximal end of the divided left subclavian artery The pumps are of the non-occlusive De Bakey roller type eliminating the need for valves.

A description of the apparatus is given by Jones and his colleagues (1955) Its disadvantages are the initial cost, difficulties in cleaning and sterilization, which are also very time consuming, and the fact that it needs to be primed with 4 litres of fresh heparinized blood These disadvantages are being overcome

A machine designed for a similar purpose has been described by Melrose (1953) and Cleland and Melrose (1955) Its pumps consist of straight plastic tubes which are squeezed between two metal plates Oxygenation is carried out in a cylinder containing a series of plastic plates over which blood is filmed and exposed to oxygen. The output is comparable to the Gibbon apparatus and less blood is required for priming, but there are similar difficulties in maintenance There is every reason to suppose that it will be clinically successful but at present no large series of cases has been reported

The low-flow extracorporeal circulation

A different approach was made by Andreasen and Watson (1953), who showed that if the venae cavae in dogs were temporarily clamped for 30 minutes, so that venous return to the heart was reduced to that flowing through the vena azygos, many of the animals survived During this period the vena azygos flow represented about 10 per cent of the normal total venous return to the heart He postulated that during cardiac by-pass it might be possible to obtain satisfactory results using much lower flows than were hitherto thought to be necessary He confirmed this by donor circulation experiments in which one animal carried out cardiopulmonary function on its own behalf and for a recipient dog undergoing cardiac by-pass Cohen and Lillehei (1954) repeated this work and Warden and his colleagues (1954) showed that in dogs a flow-rate of three times the vena azygos

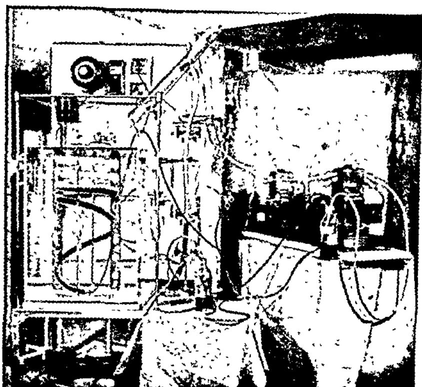


FIG 45 —Lillehei-DeWall type of pump oxygenator.

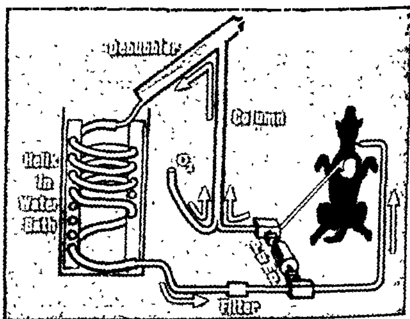


FIG. 46 —Diagram showing the experimental use of the extracorporeal circulation with carotid perfusion.

flow obtained by using donor animals in a cross-circulation study was sufficient to achieve a very high survival rate. As a result of this Lillehei (1955) was able to use a similar technique in cases of congenital heart disease in children, one of the parents providing the donor circulation during cardiac by-pass. Even if the risks to the donor are slight, it is difficult to justify a surgical operation carried out on two people in order to benefit one of them.

The next logical step was to devise a pump oxygenator simple enough to deal with relatively small blood flows (DeWall and his colleagues, 1956).

The Lillehei-DeWall pump oxygenator

The most important principle upon which this apparatus is designed is that the blood flow is predetermined for each patient. Experimental studies suggested that a flow of 35 millilitres per kilogram of body-weight per minute was enough to maintain a patient during the period of cardiac by-pass required for accurate unhurried surgery. The weight of the patient determines the total flow per minute. This is a minimal requirement and recent work indicates that flows nearer 60–70 millilitres per kilogram per minute are probably desirable, particularly in children.

The artificial heart is the sigmamotor pump commercially available in various models with rated outputs of 2–8 litres per minute. Each unit consists of a single motor with two pump heads, the flow through each of which may be varied independently. One head accepts blood from the cannulated venae cavae and the other transmits oxygenated blood to a cannula placed in the aorta. Each pump head consists of a series of metal fingers which compress in rapid sequence a siliconed latex tube against a fixed plate, hence its description as a finger pump. The pump is occlusive, there is undirectional flow and no internal valves are necessary. Venous blood passes from the pump head to an oxygenator (Figs. 45 and 46) which is composed entirely of polyvinyl chloride and is cheap and disposable. Blood enters the lower end of a column with about 10 times its own flow of oxygen. The latter is transmitted through a bung drilled with 72 small openings. Large bubbles are formed which pass to the top of the column and then enter an almost horizontal debubbling chamber. The latter is coated with silicone which tends to disperse larger bubbles and has an outlet for excess gasses. The oxygenated blood then travels down a helix or spiral which is suspended in a thermostatically controlled water bath. This corrects extracorporeal cooling, and during the descent of blood in the coil, smaller gas bubbles rise to the top. Oxygenated blood leaves the helix at its lower end, passes through a filter and then through the arterial pump head.

The oxygenator has been constantly redesigned and simplified, and recently a disposable sheet oxygenator has been described by Gott and his colleagues (1957) (Fig. 47). In the same paper details are also given of a new type of pump which may have advantages over the sigmamotor pump. The advantages of this heart-lung machine lay in its simplicity, cheapness and ease of maintenance. Only about 1,200 millilitres of fresh heparinized blood is required to prime it. There is little doubt, however, that trauma to the blood is greater because of the method of bubble oxygenation as opposed to filming and because of the occlusive nature of the finger pump.

The low-flow principle has prompted the use of a membrane oxygenator evolved from work on the artificial kidney by Kolff and his colleagues (1956).

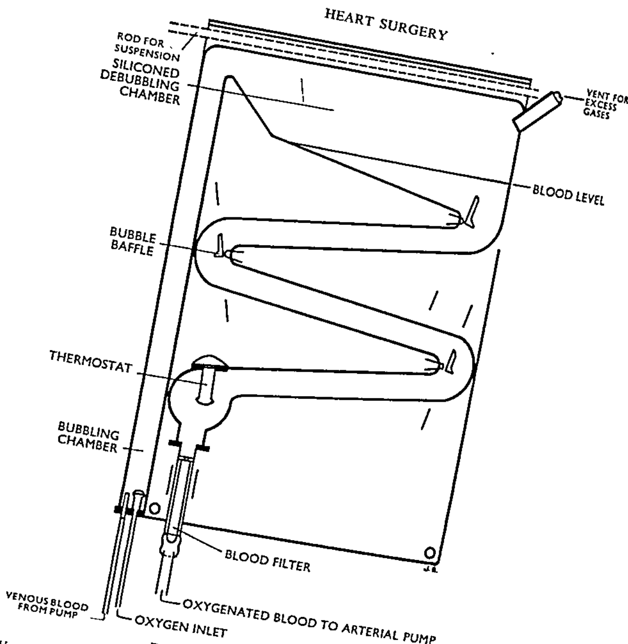


FIG 47.—A disposable sheet oxygenator.

Venous return from the open by-passed heart

When the beating heart is successfully by-passed and cardiotomy performed a dry field is not yet obtained because of blood from the coronary sinus, thebesian veins, divided coronary arteries and the bronchial circulation returning to the left atrium About 10 per cent of the total aortic inflow usually escapes in this way and it may rise to as much as 3 times this amount. Even when low flows are used this constant stream across the field of operation makes accurate suturing very difficult, particularly in the presence of a sucker, which causes trauma to the blood as it is removed. The latter may be returned to the machine in the case of the Gibbon

apparatus, but its addition to the small volume bubble oxygenator produces prohibitive trauma to the blood, and in practice most of the myocardial venous return is discarded. An additional quantity of fresh heparinized blood is required to make good this loss.

Controlled cardiac arrest

The concept of arresting the heart during cardiac by-pass was suggested by Melrose and his colleagues (1955) with the use of potassium citrate When by-pass has been achieved, a clamp is placed across the aorta between the coronary and

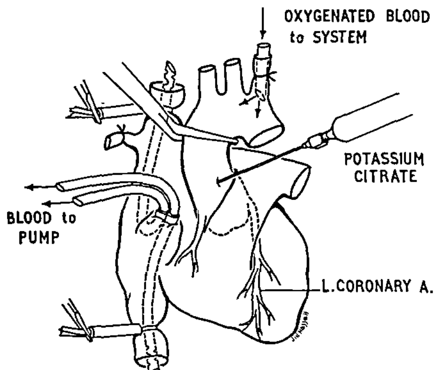


FIG 48.—Induced cardiac arrest during by-pass

the innominate arteries and a mixture of potassium citrate and blood is injected into the aortic root (Fig 48) The heart is rapidly arrested in diastole and surgery can then be carried out in a still, dry field. In great measure this also solves the problem of how to deal with the myocardial venous return

When the clamp is removed from the aorta at the completion of the intracardiac operation and the heart commences to beat, there is, however, a torrential flow through the coronary sinus until the heart has recovered its tone to allow closure of the cardiotomy and cessation of by-pass.

The extracorporeal circulation at low temperatures

A combination of hypothermia and the extracorporeal circulation has suggested itself to many workers particularly for low-flow perfusions. Gollan, Blos and Schuman (1952) reported experimental work in this field and Sealy and his

colleagues (1957) described a low-flow extracorporeal circulation combined with surface cooling to 30–31° C. in 7 patients with 6 survivals. In only 1 patient was a ventricular septal defect closed and this was the sole fatality. The use of a solution of potassium, magnesium and Prostigmin to produce cardiac arrest was described.

Conclusions

There is no doubt that the ideal heart-lung machine has yet to be devised. There are disadvantages in using high flows because the blood is subjected to an increased amount of trauma during its extracorporeal course, particularly as it passes through cannulas which of necessity are of narrow bore. On the other hand, low flows when used for long periods of cardiac by-pass produce profound adverse biochemical changes, many of which are not well understood. It is likely that some compromise will be found so that the ideal flow-rate will be established.

Although at present hypothermia and the extracorporeal circulation are the only two methods available for facilitating visual intracardiac surgery, it is not unlikely that other entirely different approaches may be made to achieve the same ends but with greater simplicity and safety.

ABSTRACTS RELATING TO HEART SURGERY

Congenital heart disease

Creation of pulmonary artery stenosis in cases with pulmonary hypertension

Review of results.—MULLER and DAMMANN (1956) review the results following the creation of pulmonary artery stenosis in 25 patients with congenital cardiovascular [illegible]

the pulmonary [illegible]
and is often int[illegible]
ment may take [illegible], increased pulmonary resistance and [illegible] In time, however, the shunt may be [illegible] cyanosis then become progressive and [illegible] creating pulmonary artery stenosis [illegible]

[illegible]

infants the operation undoubtedly saved the [illegible]

[illegible]

... septal defect and left to right shunts: there were 3 deaths in the

...

edges bevelled, silk sutures are inserted through ... sponge is positioned in the defect the ledge of the sponge will lie on the left atrial side of the septum and the sutures can be tied on the right of the septum. Prior to reopening the atrial clamp, heparin is given in a dose of 1·5 milligrams per kilogram of body weight; an additional dose of 0·75 milligram per kilogram of body weight is necessary if the well remains open longer than 20–30 minutes, or if clotting occurs within the well before this time.

... of death following operation

... sis of the causes of death in ... performed on children

...

... is centred in the 44 deaths in ... ain damage, 6 were operated ... introduced. 7 children died of heart failure following ... children ... piratory ... opera- ... teriosus caused 4 deaths during anastomosis and was the presumptive cause of death in a fifth; 2 deaths ... There were 15 ... great ves... ... there have been no deaths, the first ... were divided. ... the adult type

...

... improper procedure was used or both. The anaesthetic of choice was cyclopropane, it was not found to cause cardiac irregularities. Controlled respiration was not harmful in the present series.

Mitral commissurotomy

Analysis of results

...

stage and 6 patients died after periods ranging from 6 weeks to 3 years. In 41 cases the physical condition showed improvement. The increase in functional capacity was noteworthy among patients with uncomplicated mitral stenosis. In 4 instances the murmurs disappeared and 11 patients no longer had a mitral diastolic murmur. On the other hand, a mitral systolic murmur developed in 14 cases. On electrocardiography a small group of patients showed regression of right ventricular hypertrophy. Radiological examination revealed that in the majority of cases the size of the cardiac silhouette was either unchanged or smaller. Better results were obtained among patients without calcification of the valves. Data derived from cardiac catheterization showed good agreement with the improvement observed clinically. Evidence of rheumatic activity subsequent to the operation was obtained in 8 cases. Recurrence of stenosis was not encountered. One patient experienced an attack of left hemiplegia due to embolism but made a satisfactory recovery. The authors conclude that commissurotomy is of considerable value in the treatment of mitral stenosis.

Extracorporeal circulation

Gibbon-type pump-oxygenator

fo[illegible]

ca[illegible]

the [illegible]

chamber of the heart and returning the blood under low vacuum to the oxygenator. Respiratory exchange takes place on the vertical screens of the apparatus and subse- [illegible] As a result of the interaction of [illegible] evel. A safe extra- [illegible] l which returns to the patient during [illegible] nous pressure, the and the *p*H of the [illegible] otal blood volume. [illegible] ors state that flows [illegible] electroencephalo- [illegible] iac action was well [illegible] child after extracorporeal circulation was discontinued. No patient suffered from ventricular fibrillation [illegible]

the use of the oxygenator

Molar sodium lactate

Effect in cardiac surgery

BLAKEMORE and his colleagues (1956) present 3 case reports in which the administration of molar sodium lactate appeared to exert a beneficial effect during cardiac surgery. Severe bradycardia w[illegible] order to maintain the [illegible] an atrio-septal defect. [illegible] Although the ventricles were [illegible] slow and ineffective. Fibrillation recurred, but rapid improvement occurred after the intravenous injection of molar sodium lactate. In the second case an operation was performed for the relief of aortic stenosis affecting a man aged 53 years. When the surgeon's finger struck the membranous ventricular septum bradycardia and ventricular fibrillation ensued. Various resuscitative measures were of no avail, but improvement

took place after the administration of molar sodium lactate, 2,700 millilitres, during a period of 18 hours The third patient was a woman with severe mitral stenosis. Insertion of a suture through the mitral annulus precipitated an attack of ventricular fibrillation [illegible]

clinical studies indicate that the effect may be associated with changes in the potassium ion content of the blood In experiments upon animals with hyperkalaemia and in patients with hyperpotassaemia the electrocardiographic changes can be reversed by the rapid administration of molar sodium lactate by the intravenous route. There is evidence, however, that consideration must also be given to factors such as changes in *p*H and the concentration of serum sodium.

BIBLIOGRAPHY AND REFERENCES

Andreasen, A T, and Watson, F (1953) *Brit J Surg*, **41,** 195.
Bailey, C. P, Cookson, B A, Downing, D F, and Neptune, W. B. (1954). *J thorac. Surg*, **27,** 73
Bigelow, W G., Lindsay, W. K, and Greenwood, W F (1950) *Ann. Surg*, **132,** 849
Bjork, V. O (1948) *Lancet*, **2,** 491
Blakemore, W S, Zinsser, H F., Kirby, C K, Bellet, S, and Johnson, J. (1956). *Ann. Surg*, **144,** 511
[illegible]
(1951). *Surgery*, **29,** 697
[illegible]
— Miller, B. J, Dobell, A. R, Engell, H C, and Voigt, G B (1954) *J thorac Surg*, **28,** 235
[illegible]
Butterworth
Janton, O H., Davila, J. C, and Glover, R P. (1956) *Circulation*, **14,** 175.
Jones, R E, Donald, D. E, Swan, H. J C, Harshbarger, H G, and Kirklin, J W (1955). [illegible]
[illegible] (1955) *Postgrad Med*, **17,** 388
Melrose, D G (1953) *Brit. med J.*, **2,** 57
— Dreyer, B., Bentall, H H, and Baker, J B E (1955) *Lancet*, **2,** 21.

Muller, W. H., Jnr., and Dammann, J. F. (1956). *Ann. Surg.*, **143**, 816.
Mustard, W. T., Chute, A. L., Keith, J. D., Sirek, A., Rowe, R. D., and Vlad, P. (1954). *Surgery*, 36, 39.
Potts, W. J., McQuiston, W. O., and Baffes, T. G. (1956). *Arch. Surg, Chicago*, **73**, 508.
Ross, D. N. (1954). *Guy's Hosp. Rep.*, **103**, 97.
Scurr, C. F., and Organe, G. S. W. (1956). In *Surgical Progress.* Ed. by E. Rock Carling and J. Paterson Ross London; Butterworth.
Sealy, W. C., Brown, I. W., Young, W. F., Stephen, C. R., Harris, J. S., and Merritt, D. (1957). *Surg Gynec. Obstet.*, **104**, 441.
Swan, M., and Blount, S. G. (1956). *J. Amer. med. Ass.*, **162**, 941.
Warden, H E., Cohen, M., Read, R. C., and Lillehei, C. W. (1954) *J. thorac. Surg.*, **28**, 331.

ANAESTHETIC ADVANCES

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DEATHS ASSOCIATED WITH ANAESTHESIA

Recent additions to the anaesthetic literature did not deal with new techniques but provided comprehensive and important data on the avoidance and treatment of old problems.

Edwards and his colleagues (1956) analysed the details of 1,000 deaths associated with anaesthesia reported to the Association of Anaesthetists for a 5½ year period ending April, 1955. Although it was not suggested that statistical figures could be drawn from the investigation it is nevertheless a humbling reminder to anaesthetists that 589 (59 per cent) of the reported cases are attributed by the authors to probable errors in anaesthetic technique. They go so far as to say that 276 (46 8 per cent) of these patients would probably have made a complete recovery if the anaesthetic or surgical misadventure had not occurred Recovery would have been doubtful in 214 cases (36 4 per cent) and death inevitable in 99 (16·8 per cent) (Table I).

The common factor in the majority of cases seems to be inexperience of the administrator or lack of knowledge, or both It would appear that the elimination of these accidents will depend upon the better education of the anaesthetist of the future

The biggest problem with which the anaesthetist has to contend is usually mechanical, and no less than 110 patients (18·9 per cent) lost their lives due to vomiting or regurgitation of gastric contents (Table II). The previous report by Morton and Wylie (1951) emphasized the dangers of inhalation of gastric material.

It is striking that of the 110 cases no less than 92 patients inhaled fluid contents and only 10 inhaled solid or semi-solid vomitus The judicious passage of a stomach or oesophageal tube would have removed the danger of the fluid content in most of these cases, although the danger of solid matter is still a problem Furthermore, 9 deaths occurred in the post-operative period because the stomach was not kept empty until the pharyngeal and laryngeal reflexes had returned.

TABLE I

TABULATION BY CATEGORY AND SITE OF OPERATION OF 1,000 REPORTED CASES OF DEATH ASSOCIATED WITH ANAESTHESIA

	Category										
Site of Operation	*Anaesthetic (reasonably certain)*	*Anaesthetic (very probable)*	*Surgical and anaesthetic*	*Surgical*	*Inevitable*	*Fortuitous*	*Unassessable*	*Inadequate data*	*Total*	*Total Anaesthetic (1, 2, 3)*	*% Anaesthetic*
E.N.T.	30	4	4	—	1	1	3	1	44	38	86
Obstetric	29	4	—	3	3	1	1	1	42	33	79
G.U.	49	18	2	14	10	2	9	6	110	69	63
Stomach and duodenum	56	23	—	11	22	3	9	9	133	79	59
Small and large bowel	81	24	3	11	30	4	19	12	184	108	59
Other abdominal	36	7	1	13	21	1	10	6	95	44	46
Hernia (all types)	36	4	—	—	3	1	3	—	47	40	85
Thoracic	15	8	2	30	15	5	9	6	90	25	28
Endoscopy	9	—	—	2	2	—	—	—	13	9	69
Thyroid and other neck operations	19	2	—	3	—	—	3	2	29	21	72
Dental and oral	13	—	—	—	1	—	3	1	18	13	72
Orthopaedic	29	8	—	4	12	17	7	1	78	37	47
Plastic and superficial	28	4	—	2	5	—	7	1	47	32	68
Gynaecological	20	3	1	4	3	3	1	—	35	24	69
Neurosurgical	4	1	—	4	2	—	1	4	16	5	31
Other	9	3	—	3	1	—	3	—	19	12	63
Totals	463	113	13	104	131	38	88	50	1,000	589	59

(After Edwards, G., Morton, H. J. V., Pask, E. A., and Wylie, W. D. (1956). *Anaesthesia*, 11, 194.)

TABLE II

CASES IN WHICH FATAL REGURGITATION OR VOMITING OCCURRED

Surgical Cases

Abdominal		
Strangulated hernia	17	
Peritonitis	10	
Obstruction due to carcinoma or adhesions	8	
Burst abdomen	6	
Perforated peptic ulcer	6	
Partial gastrectomy	5	
Mesenteric thrombosis	4	
Volvulus	4	
Clot retention	4	
Twisted ovarian cyst	3	
Gastroenterostomy	2	
Laparotomy for haemorrhage following appendicectomy	1	
Intussusception	1	
		71
Non-abdominal		
Accidents (cuts, burns, fractures)	6	
Unsatisfactory preparation of non-acute cases (including 6 diabetic patients)	15	
Others	3	
		24
Obstetrical cases		
Caesarean section	9	
Forceps delivery	6	
		15
Total		110

The danger of inhalation of fluid is greatest, unfortunately, where the more experienced anaesthetist is not always available, and it is in the casualty theatre and labour ward where the menace of the full stomach is predominant. Here, frequently, unprepared patients are submitted to anaesthesia by inexperienced administrators It is sad to see in this report that there were 42 deaths during labour and, with a gradual elimination of obstetric problems, anaesthesia appeared to be the largest factor in maternal mortality (29 cases)

Muscle relaxants are not free from implication in a number of these deaths due to errors in ventilation. Beecher and Todd (1954) give the mortality with relaxants in the United States of America as 1 in 450, and this is a serious reflection on the administration of these drugs According to the report anaesthetists appear to be guilty of taking over the control of respiration and then performing it inadequately, the so-called "respiratory-sparing" action of some muscle relaxants may give rise to a most dangerous state of affairs of hypoventilation with its concomitant hazards of carbon dioxide accumulation and retention Adequate pulmonary ventilation cannot be maintained by so-called "assisted respiration" and can only be achieved by fully controlled respiration.

Inadequate management of airway difficulties has been the cause of many of these anaesthetic disasters, whether due to mismanagement of upper respiratory tract obstruction due to disease, difficulties during endotracheal anaesthesia, or

post-operative obstruction due to inadequate observation in the presence of pharyngeal relaxation or the aspiration of blood during or after throat and nose operations. Again, the experience of the administrator is often the critical factor in this type of case.

Intravenous barbiturates are still the easiest way of rendering a patient unconscious and appear to be universally used as inducing agents. Thiopentone is a very powerful drug and is implicated in 107 deaths in the report. In some cases, despite the serious condition of the patient, a dose of thiopentone as high as 0·75 gramme was given, but in other cases death was associated with the injection of quantities as small as 0·15–0·2 gramme. The more ill the patient the closer the anaesthetic dose of thiopentone approximates to the lethal dose. The report bears out the dangers of thiopentone in inexperienced hands and reminds anaesthetists that it must not invariably be used for induction.

The figures and details presented in this paper are a cause for serious reflection by anaesthetists. Although some of the deaths were inexplicable the majority were due to departures from accepted anaesthetic principles and practice, and the remedy can only lie in improved teaching and training in the future.

CARDIAC ARREST

The problem of cardiac arrest increases as the scope of surgery develops. Milstein (1956), in a very comprehensive and excellent article, deals with the emergency of cardiac arrest. His views agree with those of other contemporary workers (Wylie, 1956; Zoll and his colleagues, 1956).

It is evident that the most difficult problem is to determine the exact moment when the heart stops, because from that point on there are only three minutes in which to restore normal circulation if complete success is to be achieved. In the past many alternative means of restoring circulation have been suggested, such as cardiac puncture, precordial tapping, and so on, but all these methods may or may not work and thus deprive the patient of those very valuable moments when the one method that will work is delayed. Milstein shows very clearly that the quickest and best method of restoring the circulation is to open the chest and institute cardiac massage by manual compression of the heart. He points out the obvious reluctance to open the chest, but this must be overcome.

In dealing with the various forms of arrest it seems that to deal successfully with ventricular fibrillation a defibrillator is necessary, but, as many hearts will return to normal rhythm without the use of a defibrillator, its absence should not deter one from opening the chest. An external defibrillator and artificial pacemaker has been suggested and used successfully for cardiac resuscitation, but there are a great many disadvantages in using this technique (Zoll and his colleagues, 1954; Editorial, 1956).

The drill for the emergency of cardiac arrest has been formulated and presented as a poster which, it has been suggested, should be available wherever anaesthetics are given (Editorial, 1956). Milstein (1956) reported that where the possibility of the emergency of cardiac arrest is prepared for, the percentage of cases successfully resuscitated increases enormously.

Nowadays, wherever anaesthetics are given the means of performing cardiac resuscitation should be available. This consists of two parts: (1) there must be a

scalpel on every anaesthetic trolley—because once the emergency has arisen the chest *must be opened immediately; and (2) a cardiac resuscitation drum must be* within easy reach, containing the necessary drugs and instruments, in case the mere restoration of circulation by manual compression proves inadequate.

THE EXPLOSION DANGER IN THE OPERATING THEATRE

The fear of explosion in the operating theatre is one that has been present for many years and although the incidence in Great Britain is low compared with the United States of America it nevertheless remains a real hazard Furthermore, the possibility of medico-legal action following such accidents together with the increasing use of the diathermy make it imperative for this subject to be given the closest attention by anaesthetists and surgeons.

The Ministry of Health Report (1956) provided important data on the incidence of anaesthetic explosions in Great Britain for the period June, 1947–June, 1954.

TABLE I

Anaesthetic Explosions 18th June, 1947, to 29th June, 1954
Frequency of Accidents—Yearly—Monthly

Year	*Total*	*Month*											
		1	2	3	4	5	6	7	8	9	10	11	12
1947 (June)	1						1						
1948 .	4	1									1	1	1
1949 .	3	1					1	1					
1950 . .	1				1								
1951 . . .	5	1								1	2	1	
1952 . .	9		2		2	1		1		1			2
1953 . .	8	1		3	2					2			
1954 (June)	5	2		1	1		1						
Total	36	6	2	4	6	1	3	2	—	4	3	2	3

6 Months Winter (November–April) 23 (64%)
6 Months Summer (May–October) 13 (36%)

TABLE II

Anaesthetic Used

Anaesthetic	*Accidents*	*Anaesthetic*	*Accidents*
O + C . .	6	O + T + G	1
O + C + G .	6	O + C + E	1
O + E .	8	Ethyl chloride followed by	
O + E + G	10	O + E + G	1
O + E + C + G .	2	Open ether	1
			36

O = Oxygen. E = Ether.
G = Nitrous Oxide. C = Cyclopropane
T = Trichloroethylene.

(The above tables are from Ministry of Health Working Party Report on Anaesthetic Explosions, 1956)

Inflammability of anaesthetic agents

Of the anaesthetic agents in everyday use diethylether, cyclopropane and ethyl chloride are the most inflammable, the risk of explosion being increased by the addition of oxygen or nitrous oxide. The limits of inflammability of diethyl ether in air are 1·85–36·5 per cent (Lee, 1953; Guest, Sikora and Lewis, 1952) and 2·1–82 per cent in oxygen; with cyclopropane in air the range extends from 2·4–10·3 per cent and in oxygen 2·48–60 per cent whilst ethyl chloride and air is inflammable in a percentage of 4–14·8 and 4·05–67·2 per cent in oxygen. Cyclopropane is particularly dangerous because of the ease of ignition and it has been estimated that it requires a spark of 45 times less than that required to ignite a 4 per cent ether vapour (Roberts and Hewer, 1953). Trichloroethylene, although completely safe in air, can be ignited when enriched with 33 per cent oxygen or pure oxygen at a temperature exceeding 78° F (25·5° C), the ignition temperature in oxygen being 786° F (419° C). The minimum quantity of trichloroethylene to form an explosive mixture in these conditions is said to be 10 per cent, therefore, it is hardly feasible that these conditions would be present during ordinary anaesthesia. Oxygen, under pressure, forms a highly explosive mixture with oil or grease and particular care must be taken to see that reducing valves are quite free of grease.

All of the inflammable agents are heavier than air and therefore the presence of an inflammable mixture is more likely nearer the floor. In this connexion it is considered that the zone of spark risk extends between the floor level and a height of 4 feet 6 inches above this for a horizontal radius of 4 feet from any part of the anaesthetic apparatus or container (Ministry of Health Report, 1956).

TABLE III

PROBABLE SOURCES OF IGNITION

	Number	*Percentage*	
Static spark	22	61·1	69 4
Static spark or open gas burner	1	8·3	
Static spark or electric heater	1		
Static spark or smouldering towel	1		
Diathermy	5	14 0	
Spark in switch or cut-out	3	8·3	
Faulty valve in gas cylinder	1	8·3	
Foreign matter in valve	1		
Smoking (?)	1		
Totals	36	100·0	

(From Ministry of Health Working Party Report on Anaesthetic Explosions, 1956)

Sources of ignition

The ignition of inflammable gases can occur from several sources; the risk of [illegible] inflammable agents is obvious and their exclusion [illegible] switches, suction [illegible] t supervision of [illegible] wiring circuits is also essential. Of greater importance in the cause of explosions (*see* Table III) is the presence of *static electricity* charges arising from the rapid

contact and separation of dissimilar non-conducting materials or the passage of gases to and fro along anaesthetic tubing and rebreathing bags. These charges can be measured *with the use of a "Statigun" which records the potential gradient in* volts per foot and is available for use to all hospitals together with the advice of the Ministry of Health Electrical Safety Engineers Where possible blankets and pillows, which can build up a considerable charge of static electricity, should be replaced by antistatic substitutes such as cotton, linen or viscose rayon; theatre personnel should be equipped with shoes having anti-static rubber soles for the dissipation of charges. Likewise, anti-static rubber should be used for all anaesthetic tubing and rebreathing bags. If this is not immediately available the risk of a build-up of static electricity charges can be lessened by washing the anaesthetic tubing through with water before use.

With the use of antistatic rubber on the wheels of theatre equipment there should be provided an electrically continuous pathway to the floor where the charges should be dissipated. Floors of the terrazzo type are usually sufficiently conductive but for temporary use other non-conductive floors can be improved by washing with soapy water and the laying down of damp sheets

In the same way the humidity of the operating theatre or anaesthetic room can do much to prevent the accumulation of static charges. All theatres should be *equipped with a hygrometer as the relative humidity should never be allowed to* fall below 50 per cent, while some reports suggest that 60 per cent should be the minimum figure (Bulgin and his colleagues, 1949).

Another method of preventing static discharges is by ionizing the air using radioactive thallium but this is still largely in the experimental stage.

Non-inflammable anaesthetic agents

Fluoromar

The danger of fire and explosion in the operating theatre has stimulated work in the search for other non-inflammable anaesthetic agents It was found by some workers that fluorinated ethers and hydrocarbons possessed considerable anaesthetic properties and the most promising of these have been investigated.

Trifluoroethyl vinyl ether (CF_3-CH_2-O-CH=CH_3, Fluoromar) was studied extensively by Krantz and his colleagues (1953) It is a colourless liquid with a boiling point of 42·7° C It is completely stable in the presence of hot sodalime and free fluorine is not released in the body. Liver dysfunction following its use was not observed and furthermore the heart was not sensitized to adrenaline The first clinical reports in Great Britain were published by Gainza and his colleagues (1956) and Dundee (1956) found that anaesthesia with Fluoromar was, in many ways, similar to diethyl ether although Fluoromar was less irritating to the respiratory passages. Hypotension tended to occur more frequently with deeper anaesthesia and could usually be reversed when the anaesthesia was lightened As with trichloroethylene, tachypnoea was often observed and could be controlled by the administration of intravenous pethidine. It was found that Fluoromar tended to depress the respiration more than diethyl ether. Muscle relaxation was variable and Dundee thinks that a synergism exists between Fluoromar and the tubarine-like relaxants, as with diethyl ether Later work has shown, however, that although the

spark energy for ignition is much higher than that of the other ethers the lower limit of inflammability is 4 volumes per cent which is within the anaesthetic range of 3–8 volumes per cent. Therefore, the danger of inflammability still exists and it is unlikely that this agent will gain a place in Great Britain.

Halothane

Reports have been received on the initial trials of a new fluorinated hydrocarbon, 2 : bromo 2 chloro 1 . 1': 1 trifluoroethane (CF_3-CHCl Br) known as halothane (*Fluothane*). The first comprehensive report on the properties of halothane was given by Raventós (1956) In conjunction with his colleague Suckling, the physical properties of this agent were determined; it is a clear liquid with a boiling point of 50 2° C and specific gravity 1·86. Its vapour pressure at 20° C is 243 millimetres of mercury, solubility in 100 parts of water 0·345 and oil/water solubility 330 It is a non-irritant vapour, its smell being sweetish and not dissimilar to chloroform or trichloroethylene. Slow decomposition when exposed to light can be prevented by the addition of 0·01 per cent w/w thymol but usually the liquid is contained in dark bottles. Its outstanding virtue is its non-inflammability and, mixed with oxygen, it has proved to be non-inflammable in a range of 0·5 per cent to 50 per cent v/v. Furthermore, it is completely stable in the presence of soda-lime and can therefore be used in closed-circuit apparatus.

Animal experiments. In animal experiments Raventós was impressed with the ease of induction which was smooth and uneventful in all cases. Using mice it was found that a concentration of 1–2 per cent halothane produced anaesthesia in less than 5 minutes and recovery was equally rapid Similar results were obtained in dogs and monkeys, 2–4 per cent halothane in air produced a quiet induction with no sign of excitement and full anaesthesia with loss of corneal and laryngeal reflexes was usually obtained within 5 minutes Further anaesthesia could be maintained on 0·8 per cent or 1–2 per cent halothane depending on whether the animal had been given premedication or not. Recovery was rapid and uneventful and post-operative vomiting was infrequent. Other observations included the absence of salivation and mucus secretion, that muscle relaxation was usually adequate and that little bleeding was seen in the operative field.

Arterial blood levels of halothane were estimated at different levels of anaesthesia; thus, under conditions of respiratory arrest due to overdosage, the blood level was 28–35 milligrams per 100 millilitres, while in Stage 3 Plane 4 anaesthesia the blood level was 17–22 milligrams per 100 millilitres Stage 3 Plane 2 anaesthesia gave a level of 14 milligrams per 100 millilitres and early recovery with return of the corneal reflex was equivalent to a blood concentration of 7–9 milligrams per 100 millilitres. From this experimental work it was concluded that halothane was approximately twice as potent as chloroform and approximately four times as potent as diethyl ether.

Other favourable observations were on the heart and the electrocardiogram, in which no obvious abnormalities were noticed. That the heart was sensitized to adrenaline was shown by the fact that ventricular fibrillation could be induced from the intravenous administration of adrenaline or nor-adrenaline. It was [illegible]

200 millilitres of 1 in 100,000 adrenaline solution) or intramuscularly (5 millilitres of 1 in 1,000 solution), no cardiac irregularities occurred.

Some less attractive features were apparent from observations of respiration, heart-rate and blood-pressure. It was noted that halothane depressed both the amplitude and the rate of respiration, usually in proportion to the concentration of vapour used but even with a vapour strength of 4 per cent it took 30 minutes to produce respiratory arrest, and then a further 10 minutes to produce cardiac arrest Otherwise, spontaneous respiration soon recurred on discontinuing the halothane and inflating with oxygen. The heart rate was found to drop uniformly during induction but returned to a somewhat higher rate during maintenance. At the same time a blood pressure fall roughtly proportional to the concentration of vapour occurred and was greater in cats and rabbits than in dogs A pronounced fall was apparent when artificial respiration with halothane was instituted. From his experiments Raventós concluded that the cause of the hypotension was due to a sympathetic ganglionic block, the mesenteric ganglion being more sensitive than the superior cervical ganglion More recent work suggests that halothane causes a diminution of cardiac output and that this, together with some central vasomotor action, is chiefly responsible for the hypotension.

Routine liver and renal function tests in animals showed no significant changes but histopathological changes were observed in sections of the kidney, the proximal convoluted tubules being dilated and the cells also showing slight cytological changes

Clinical trials.—These soon followed the publication of the experimental work on halothane and Johnstone (1956) published his results on 500 patients Initially, halothane was given to a series of 50 patients with normal cardiovascular and respiratory systems After premedication with atropine and pethidine, anaesthesia was induced with sodium thiopentone and maintained on 50 50 nitrous oxide and oxygen (10 litres) and halothane 2·2–3·2 per cent administered from a specially calibrated Trilene bottle In all cases the anaesthetic course was smooth and particularly favourable observations were the rapid return of reflex activity and lack of vomiting Hypotension and bradycardia were frequent occurrences In a second series of 50 cases it was found that the incidence of hypotension was considerably lessened when a further 0·5 milligram of atropine was administered and the halothane percentage reduced to approximately 1 per cent Furthermore, the pulse rate remained in the region of 84 per minute.

The investigation was then extended to a larger series of 400 cases of all descriptions, including patients with cardiovascular, pulmonary, liver and kidney dysfunction. In all of these cases an extra 0 5 milligram of atropine sulphate was administered Sufficient muscle relaxation was obtained in the presence of adequate spontaneous respiration and the tachypnoea often caused by halothane was reduced by the intravenous administration of pethidine It was also found that the respiratory rate was often considerably increased following surgical stimulation. Particularly striking in all cases was the absence of post-operative shock No harmful effects were apparent in patients with heart, lung, kidney or liver disease. Ten per cent of cases in this series showed a blood pressure fall to 90 millimetres of mercury but after this the systolic level gradually returned to normal limits Patients under the effect of halothane were found to be particularly sensitive to posture and blood loss.

Hypotension associated with halothane was found to be corrected adequately, without causing cardiac arrhythmias, by methoxamine hydrochloride.

Occasional electrocardiographic changes occurred—these consisted chiefly of AV nodal rhythms and occasional ventricular extrasystoles. The ventricular extrasystoles occurred during times of ventilatory impairment, however, and were probably a reflection of suboxygenation and carbon dioxide accumulation. In the majority of cases there was normal sinus rhythm throughout.

In an early case when muscle relaxation was judged to be inadequate 15 milligrams of d-tubocurarine chloride were given. This was followed by a profound fall of blood pressure with disappearance of the pulse on commencement of controlled respiration The blood pressure returned after reversal of the d-tubocurarine chloride with atropine and prostigmine and return of spontaneous respiration but an alarming bradycardia then followed. In subsequent cases very much smaller doses of d-tubocurarine chloride, 5–10 milligrams, or suxamethonium chloride, were used. That some block of the sympathetic ganglia occurs with halothane is undoubtedly true and great care should be exercised with the use of ganglion-blocking agents such as d-tubocurarine chloride and the methonium compounds.

A further clinical trial was carried out by Bryce-Smith and O'Brien (1956). In this series halothane was administered either by the open-drop technique or from a specially calibrated E.M.O inhaler. It was found that a concentration of 0·5 per cent halothane in air (v/v) produced little or no analgesia, while 1 per cent halothane produced unconsciousness In most cases, however, 2 per cent halothane in air was required to produce satisfactory surgical anaesthesia Many of Johnstone's original observations as regards atropinization, blood-pressure fall and muscle relaxation were confirmed but the authors were disturbed by the degree of respiratory depression which occurred with halothane and air, often necessitating the addition of oxygen and controlled ventilation. Post-operative shivering or rigidity was noted and has also been observed in other series.

Summary

From these experimental and clinical reports it can be seen that halothane has many advantages as an anaesthetic agent, notably its complete lack of inflammability, the ease of induction with lack of secretions and the absence of post-operative side-effects. On many occasions the hypotensive action could be used to good effect On the other hand the occurrence of respiratory depression with suboxygenation, carbon dioxide accumulation and possible cardiac arrhythmias is fraught with danger Also, in most cases, the depth of anaesthesia has to be increased to provide muscle relaxation. Of some importance is the fact that halothane corrodes tin and light metal alloys and again, at the moment, its price remains prohibitively high for most centres.

[illegible] ...h particular reference to [illegible] ...tension and further tests [illegible] balance it would seem unlikely to displace the modern anaesthetic technique of light anaesthesia using thiopentone, nitrous oxide and oxygen with pethidine and the muscle relaxants. The report of the Medical Research Council Committee may well provide further important details and recommendations.

ABSTRACTS RELATING TO ANAESTHESIA

Deaths associated with anaesthesia

Report on 1,000 cases

A review of 1,000 cases of death associated with anaesthesia, reported during a period of 5½ years, is presented by EDWARDS and his colleagues (1956). Of these, 598 were regarded as anaesthetic deaths; 568 of the deaths occurred in males. The pre-operative condition

be present in these circumstances, preparation of non-acute cases was unsatisfactory in 6 diabetic and 9 other patients; the intravenous route for administration of glucose is recommended, especially in severe diabetes, vomited or regurgitated material was fluid in 92 cases, solid or semi-solid in 10, and the nature was unstated in 8 A large proportion

in 11 others; a pharyngeal airway, naso-pharyngeal tube, or endotracheal tube was

There were 26 cases associated with respiratory inadequacy due to anaesthetics and relaxants and 10 due to epidural analgesia; the data also indicate the danger of high spinal analgesia There were 14 cases of

Cardiac arrest and resuscitation

ition may occur
: usually results
the presence of
or stimulation

obstruction, inadequate

occur in circumstances other
doses of local anaesthetic ag
haemorrhage; adrenaline, which is frequently used in the treatment of cardiac asystole, often converts it into ventricular fibrillation; another infrequently recognized cause of

author has
although th
mouth insu

Anaesthetic explosions

Report of Working Party

placed on mechanical ventilating arrangements. Spark risks may be associated with the normal functioning of certain equipment, as well as with fault conditions on almost all electrical apparatus, electrostatic risks are associated with certain materials; no instance is known of an explosion directly attributable to spontaneous combustion from the

earthed or partially earthed metalwork; when two or more endoscopes are used at the same time each should be energized from a completely separate low-voltage supply; comparatively small potentials can cause serious electric shock in certain circumstances such as when contact is made direct on to the tissue, that is, without skin resistance There should be a routine and regular periodic inspection and testing of all electrical equipment and anti-static components, and also of ventilating and humidifying arrangements.

Fluothane

Investigation into properties

A report to the Medical Research Council by the COMMITTEE ON NON-EXPLOSIVE ANAESTHETIC AGENTS (1957) describes investigations into the properties of fluothane

was evidence that fluothane, in concentrations comparable to those producing a hypotensive effect, could depress a central nervous reflex, the knee-jerk, and that the magnitude and time course of this action correspond reasonably well with that on the blood pressure It is apparently better, therefore, to suppose for the time being that the hypotensive action of the drug is made up of a central depressant action, with some weakening of the heart, and possibly a small contribution of peripheral ganglion block Although not itself strongly ganglion-blocking it potentiates blocking by hexamethonium and D-tubocurarine, up to 4–5 per cent it does not produce paralysis of the neuromuscular junction, but it antagonizes suxamethonium and potentiates D-tubocurarine. A study of the clinical

properties of fluothane has been made in 245 patients undergoing operations in 4 hospitals. The results show that pharmacological and clinical experiences agree to a considerable extent in several respects: hypotension in man is marked by the retention of a warm, pink skin, and by a moderate reduction in bleeding during surgery, indicating analogies with hypotension by ganglion block or spinal analgesia; transmission through the vagal ganglia is markedly unimpaired by the anaesthetic; although no marked bradycardia occurs in the cat anaesthetized with chloralose it can be striking in man and can be [illegible]

it does not appear to be as pleasant as cyclopropane nor as safe as ether: it is obvious that it should not be administered by an untrained person, because it depresses respiration and may even arrest it in the early stages of administration, and because it depresses the blood pressure. There are certain patients for whom ether or cyclopropane is preferable; at present, therefore, the advent of fluothane has not removed the necessity for taking precautions against electrostatic charge and other electrical hazards of operating-theatre equipment. A study of calibration, for fluothane, of trilene vaporizing unit of the British *Oxygen Gases, Ltd*, *Boyle-type anaesthetic apparatus has been made by Mapleson (1957).* The main factors affecting the emergent concentration of fluothane are gas-flow, distance from plunger to fluothane surface, temperature of fluothane and tap-setting; the effect of varying eccentricity of plunger and U-tube was eliminated in all units calibrated by adopting the Hillard modification.

Hypothermia

Hypothermia in perspective is discussed by CHURCHILL-DAVIDSON (1956). The use of this technique has spread to many branches of surgery, and knowledge of the basic [illegible] The main danger *of hypothermia is spontaneous ventri-* [illegible] art beat gets slower and slower until [illegible] be made more irritable by certain factors such as anoxia, a high carbon dioxide tension, and changes in the electrolyte balance. The majority of anaesthetists now regard temperatures of 30–28 degrees C. as the optimu [illegible] minutes; in [illegible] safely. The [illegible]

Surface cooling for use in open heart surgery

[illegible] for open heart surgery is described by SELLICK (1957). The [illegible] ther and muscle relaxants; [illegible] nperature of 30 degrees C. [illegible] arming by blanket during [illegible] tion with promethazine, [illegible] itone: this is immediately [illegible] ntubation; anaesthesia is [illegible] ("Tubarine") is given to [illegible] hout the procedure. After [illegible] 5 degrees C. is circulating, [illegible] and shortly afterwards ice [illegible] The immediate rewarming

occlusion of the venae cavae, neostigmine is injected proximal to the aortic clamp; the lungs are kept gently inflated during circulatory arrest to avoid loss of time in reinflating them when the circulation is restarted. After restoration of the circulation the blanket temperature is raised to 43 degrees C., and when a rising temperature indicates rewarming of the deep tissues 50 per cent nitrous oxide is added to the oxygen; on completion of surgery a watertight dressing is applied to the wound and the patient re-immersed in the bath at a temperature of 40 degrees C , spontaneous respiration is re-established and residual curare is counteracted with atropine and neostigmine; an after-rise similar to the after-drop occurs when the patient is removed from the warm bath. The method has been used in 32 cases of open cardiotomy without mortality.

Veno-venous cooling

Ross (1956) discusses the principles underlying the application of hypothermia to cardiac surgery. It is now felt that rapid cooling within one hour followed by a short intracardiac procedure and an immediate rewarming is the first requirement of a successful clinical result. The author achieves this by delaying cooling until the chest has been opened and the diagnosis confirmed; cooling and rewarming rapidly are then carried out by the venous blood stream method. As it is the ventricular fibrillation which occurs during cooling which is the greatest danger, it is necessary to have the chest open and the heart under vision during induction of cooling An attempt is made to maintain the coronary perfusion pressure by a very slow drip of noradrenaline, prostigmine is used during the intracardiac surgery. In treating established fibrillation occurring during intracardiac manipulations the author ignores the disturbance, completes the correction of the intracardiac defect, and releases the circulation before attempting resuscitation, in this way the circulation is immediately improved with a correspondingly better chance of successful defibrillat
tone and
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tion. Bloc
this furth
tion of clotting time, which has been observed in hypothermia, has been turned to advantage in the venous cooling method in that it obviates the need for heparin in the extracorporeal cooling circ
dency to oozing, but the
drawn from a donor The
by the blood-stream coolin
the outcome in the author's clinical cases.

Application to surgery

problem because at low temperatures the brain will tolerate ischaemia for several minutes, the method is also applicable to certain types of neurosurgery, such as arteriovenous aneurysms, and to abnormalities such as aneurysms of the abdominal aorta. The method of achieving hypothermia is relatively unimportant, the time necessary to cool the patient is the most important factor. Practical problems include the type of anaesthesia used;

temperatures light nitrous oxide-oxygen is sufficient to maintain unconsciousness; the enhanced effect of drugs must also be borne in mind in connexion with post-operative sedation. The responsibility in hypothermia cannot rest entirely with the surgeon, the anaesthetist, or the cardiologist, and possibly the best arrangement is for the person most experienced in hypothermia to be in charge but to have a deputy of his own speciality. The future of the method may well lie in neurosurgery; the 15–20 minutes of circulatory occlusion which is possible at present is not long enough, and lower temperatures will have to be reached in order to increase the ischaemic time.

Cardiac effects of hypotensive drugs and muscle relaxants

COOKSON (1956) discusses the cardiac effects of certain hypotensive drugs and muscle relaxants in hypothermia. As both atropine and vagotomy have been ineffective in relieving bradycardia, the possibilities of adrenaline were investigated; doses of 10γ kilogram produced immediate relief of the bradycardia, although 50 per cent of experimental animals to which it was administered went into ventricular fibrillation soon after the initial cardiac acceleration. The drugs which relieved bradycardia in hypothermic dogs, probably by a direct effect on the sino-atrial node, were: hexamethonium chloride (C6), 20–25 milligrams per kilogram, tetraethylammonium chloride (T.E.A.), 7·5–75 milligrams per kilogram, tetrabutylammonium iodide (T.B.A.), 5–12·5 milligrams per kilogram, d-tubocurarine, 2 milligrams per kilogram and Flaxedil, 10–12 milligrams per kilogram; tetramethylammonium iodide (T.M.A.) and choline in doses up to 100 milligrams per kilogram were ineffective. The author considers that the use of these drugs in clinical hypothermia is not definitely contra-indicated provided that the anaesthetist does not administer large doses, avoids the danger of the drugs accumulating in the hypothermic state, and realizes that any cardiac acceleration resulting from the drugs may be dangerous since ventricular fibrillation may be induced.

Effects on neurophysiology

ROSOMOFF (1956) discusses some effects of hypothermia on the normal and abnormal physiology of the nervous system. A series of experiments were carried out on unselected dogs, which were anaesthetized solely by means of intravenous sodium pentobarbital; respiration was controlled continuously by a closed-system respirator; hypothermia was induced by immersion to the shoulder in iced water. Observations of the effect of hypothermia on cerebral vascular dynamics and cerebral metabolism were made by a technique developed for measuring the cerebral blood flow of the dog. An analysis of cerebral arterial and venous oxygen contents was made from periodic blood samples; the brain volumes were determined, and cerebrospinal fluid pressures and venous pressures were recorded from needles in the cisterna magna and jugular vein respectively. The results demonstrated the following effects on normal physiology: (1) a decrease in cerebral blood flow, (2) a corresponding reduction in cerebral metabolism, (3) an induced and compensated hypotension; (4) an increase in cerebral vascular resistance; (5) a decrease in brain volume, and (6) a diminution in intracranial pressure and venous pressure. Other experiments were made in which the left middle cerebral artery of the dog was interrupted at its origin at normal body temperatures in one group of animals and during hypothermia in a second group; the animals were sacrificed after 18–22 days and the brains were removed and examined. The results showed that 14 of the 15 normothermic dogs exhibited moderate to severe abnormal neurological signs; in contrast, the hypothermic dogs showed a marked reduction of both neurological and pathological manifestations; any neurological signs which were present were minimal in degree and none persisted more than 6 days post-operatively; 10 of the 15 hypothermic dogs developed no clinical abnormalities; although all but 2 animals developed evidence of infarction the infarcts were small, and the paucity of clinical manifestations is attributed to the small size and their location in relatively "silent areas" of the brain.

REFERENCES

Beecher, H. K., and Todd, D. P. (1954) *Ann Surg.*, **140**, 2.

Bryce-Smith, R., and O'Brien, H. D (1956) *Brit. med. J.*, **2**, 969.

Bulgin, D , Llewellyn, F. J , and Thomas, G. (1949). *Lancet*, **1**, 789.

[illegible]

[illegible] 479.

[illegible]

Editorial (1956). Current Comment and Case Reports *Anesthesiology*, **17**, 625.

Edwards, G., Morton, H J V., Pask, E. A., and Wylie, W. D. (1956). *Anaesthesia*, **11**, 194.

Gainza, E , Heaton, C. E., Willcox, M , and Virtue, R W (1956) *Brit. J. Anaesth.*, **28**, 411.

Guest, P. G , Sikora, V. W., and Lewis, B (1952). U S. Bureau of Mines Report.

Johnstone, M (1956). *Brit. J. Anaesth.*, **28**, 392.

Krantz, J. C. (1953) *J. Pharm* , **108**, 448.

Lee, J. A. (1953). *Synopsis of Anaesthesia*. Bristol; Wright.

Lucas, B G. B. (1956) *Proc. R. Soc. Med* , **49**, 345.

Milstein, B. B (1956) *Ann. R. Coll Surg. Eng.*, **19**, 69.

Ministry of Health (1956) *Report of a Working Party on Anaesthetic Explosions*. London; H.M Stationery Office

Morton, H. J. V., and Wylie, W. D. (1951) *Anaesthesia*, **6**, 202.

Raventos, J (1956). *Brit J. Pharm* , **11**, 394

Roberts, J E , and Hewer, A. J H (1953) *Anaesthesia*, **8**, 79.

Rosomoff, H L (1956). *Proc. R. Soc. Med.*, **49**, 358.

Ross, D. N. (1956). *Proc. R. Soc. Med* , **49**, 365.

Sellick, B. A. (1957) *Lancet*, **1**, 443.

Wylie, W. D (1956). *Brit. J Anaesth.*, **28**, 551.

Zoll, P M , Linenthal, A. J , Norman, L. R., and Belgard, A. H. (1954). *Circulation*, **9**, 482.

— — Gibson, W , Paul, M. D , and Norman, L. R. (1956) *New Engl. J. Med* , **254**, 727.

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